the OIL AND GAS JOURNAL
PUBLISHED WEEKLY
JANUARY 9, 1961

EXCLUSIVE REPORT ON

How Operators Regard LACT

p. 65

Smaller firms are cutting costs, too ▸ 41

How reorganization benefits Socony ▸ 44

What Canada's tax move means to oil ▸ 49

Cat cracker analysis for less than $200 ▸ 84

Surface clues to strat traps? ▸ 118

Texaco's Stowell Field, Winnie, Texas — Foxboro Type 37 Diaphragm Meters used on billing service.

Foxboro Diaphragm Meters eliminate costly mercury maintenance, damage from overrange

There are over 50 Foxboro T/37 Diaphragm Flow Meters in Texaco's East Texas gas fields. Some measure flare gas and gas flow to compressors while others handle billing assignments.

Foxboro Diaphragm Meters give users two distinct benefits. First — since there is no mercury to clean, or replace, they're cheaper to maintain. Second — since the T/37's unique diaphragm assembly can't be damaged by overrange, line surges and winter freeze-ups cease to be a problem.

As for accuracy — monthly checks have found only two of the 50 meters that ever needed recalibration.

Producers, pipeliners, plant men — they're all reporting superior flow metering with Foxboro Diaphragm Flow Meters. Get full details from your nearby Foxboro Field Engineer. Or write for Bulletin 7-15. The Foxboro Company, 601 Neponset Avenue, Foxboro, Massachusetts.

Texaco's Cody Field, Clarkwood, Texas—Foxboro Diaphragm Meters measuring flare gas, and gas flow to compressor.

FOXBORO

REG. U.S. PAT. OFF.

OIL AND GAS JOURNAL
Vol. 59, No. 2

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TECHNOLOGY–OPERATION

Drilling-Production

Where We Are on LACT 65

By W. B. Bleakley

This Journal survey shows that savings result from reduced labor, reduced investment and maintenance, greater accuracy and reduced downtime. Medium and large-size companies account for 93½% of installations. Both pipeliners and producers are doing research.

Research on Steel Corrosion is Reducing Petroleum Industry Costs .. 79

By Dr. E. H. Phelps

How to Reduce Drilling Costs—8 93

By Preston L. Moore

You may not have all of your hydraulic horsepower working for you. Here are some suggestions for getting full mileage from it.

How to Set Turbine Governors 94

Permeable Ball Sealers Protect Cement Jobs Better 96

By S. J. Martinez

Oil-Well Pumping—29 100

By Joseph Zaba

Refining-Processing

Sinclair Uses Sand Slurry to Scour Condensers 70

By Kenneth Brooks

It hasn't been necessary to go inside a condenser to clean the tubes in over five years at the Hartford, Ill., refinery of Sinclair Refining Co. Simple, inexpensive sand slurry cleaning is used while the exchanger is onstream.

Sampling Light Hydrocarbons with Greater Safety 77

By J. C. Ducommun

Questions on Technology 83

Cat Cracker Analysis is Simplified 84

By R. L. Flanders, R. J. Annesser, and D. A. Saville

California Standard's reaction-mix sample method is reproducible and more accurate than conventional net stream analysis. A complete plant analysis can be made for less than $200.

How to Add Refrigeration to Gas-Processing Plant 88

By C. P. Stanley

Progress Report on Tidewater's Hydrogen Plant 90

By D. H. Stormont

Three years' experience with the oil industry's largest plant (30 M.M.c.f.d.) has shown that such plants offer a dependable, efficient source of hydrogen.

BOP Protects Pumping Well During Pulling 97

Pipelining

How to Combat High Corrosion-Control Costs 72

By Thomas J. J. Degnan and N. K. Senatoroff

Cost reduction cannot rule out quality considerations and must, therefore, be based on thorough planning, careful construction, and continuous monitoring of operation.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Jan. 9, 1961

Canada is banking heavily on natural gas in 1961:

Gas, in fact, may be the Canadian industry's economic ace for several years to come.

Operators have high hopes for the gas-export program authorized last year. Some say construction of pipelines and facilities under the program will exceed Canadian expenditures on the St. Lawrence Seaway.

Crude production, however, still has a dim outlook. World oversupply and slackened Canadian business have left the oil industry producing at half capacity.

Look for pressure to continue for some kind of controls to give Canadian oil a bigger share of the home market. Such action may be in the cards this year.

These opposing gas-oil trends will be felt in exploration this year.

Activity will be concentrated in Northeastern British Columbia, the Alberta foothills, and other regions promising essentially gas reserves. Even eastern Canada will get into the act with accelerated drilling along the shore of Lake Erie, in Ontario and even Quebec.

All this will boost geophysical activity in covering the sprawling, remote, and sparsely explored provinces. Last month, 62 crews were active. This will jump to 100 by February.

You can count on this immediate problem: Growing shortage of skilled people to man geophysical crews. This reflects fluctuating demand for crews and a distaste of the profession by younger people.

▼ ▼ ▼

The Washington beat:

Plan for admitting newcomers to residual fuel-oil import program may be adopted soon to become effective in the second quarter.

Interior has made some revisions in proposal drafted last fall to enable deep-water terminal operators to become eligible for quotas. White House decision on Interior's plan is imminent.

Fuels policy study proposal gains momentum.

Latest push: A report by a committee headed by Sen. Paul Douglas says a national fuels policy would be one means of alleviating distress in depressed areas. And aid for depressed areas is high on list of Kennedy administration.

Next step: Introduction of a congressional resolution calling for a fuels study. Draft by Sen. Jennings Randolph of West Virginia is being prepared. It's similar to last year's revised version with no reference to end-use control.

Legislation already is pouring into the House hopper, most of it a rerun of last session. Among the bills: Harris natural gas, fair trade, $1.25 minimum wage, Patman's HR 11 to rule out good faith price cuts, and extension of seaward boundaries of Alabama, Mississippi, Louisiana.

Appointments to top posts at Interior are being shaped up. Announcements are expected within a few days.

For oil, chief interest is in who will replace Under Secretary Elmer Bennett and Assistant Secretary for Minerals Royce Hardy.

No change has been indicated for oil import boss or director of Office of Oil and Gas.

▼ ▼ ▼

The 1961 wage increases throughout the oil industry are being quickly wrapped up.

New contracts are spelling out the increases at 14 cents an hour or 5% for 1-year terms. Average is little different no matter what route is accepted.

Texaco, Gulf, Mobil, Atlantic, Pure, Humble, Shell on the Gulf Coast have agreed with OCAW for 14 cents an hour more. Tidewater settled for 5% at Avon on the West Coast, and Indiana Standard completed similar deal with independent group at Whiting. Most unorganized employes are getting the 5% blanket increase.

The smaller operators are hacking away at costs just as energetically as the majors, a Journal survey shows (p. 41).* The independents are scrutinizing everything that costs money—whether it involves drilling, payroll, paperwork procedure, selection of equipment or what-have-you.

Tax notes: Canada has aimed blow at foreign-controlled investments with a new tax on dividends and interest paid to foreign companies and has increased the duty on imports of foreign-made equipment (p. 49)...Oklahoma Gov. Howard Edmondson has proposed new 1-cent per M.c.f. tax on natural gas and

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*Refers to article in this issue giving more details. When no page is given, the item is a Newsletter exclusive.

a sharp increase in income tax and 1-cent hike in sales tax.

▼ ▼ ▼

Two rich Vicksburg gas-condensate discoveries by Shell are giving a bright start for the new year in Texas Rio Grande Valley exploration. The wells are 15 miles apart in western Hidalgo County.

One is 6 miles southeast of La Reforma, good for 12,700 M.c.f. of gas daily with 32 bbl. of condensate per M.c.f. from a 10,600-ft. sand. The other is in the Monte Christo area, potentialed at 3,800 M.c.f. of gas daily with an ungaged flow of condensate from an 11,300-ft. pay.

Allowable for Utah's Lisbon field has been set at 150 bbl. daily with 300 M.c.f. daily the maximum permitted flare.

Utah commission ruling has effect of limiting wells of Belco Petroleum and Pubco Petroleum. They had opposed severe curtailment pending construction by Pure of a recycling plant. Pure, the discoverer of Lisbon and major crude buyer there, had shut in its own wells.

Alaska's oil production, according to API, already is higher than that of seven other states. Its output averages more than 5,000 bbl. daily, exceeding that of Arizona, Florida, Missouri, Nevada, South Dakota, Tennessee, or Virginia.

▼ ▼ ▼

Perez Alfonzo is coming under increasing fire as time draws near for Caracas session of oil-exporting nations.

He says international pressure on his domestic oil policy is being applied to weaken prices and split united front of producers.

In contrast to Perez Alfonzo's deteriorating position, at least two Middle East delegates will attend the Caracas meeting in stronger positions. Both Tariki of Saudi Arabia and Salman of Iraq have risen to ministerial rank (p. 60).

More exploration: Union Oil is drilling ahead below 9,966 ft. in its 1 Cabawin wildcat in Australia after an encouraging show of gas at about 9,930 ft. Well is scheduled for 12,000 ft....Brazil probably won't produce any big oil unless new oil-discovery tools are developed, says Walter Link, who has just wound up a 6-year hitch as exploration chief for Petrobras. He advises private oil companies against investing exploration money in Brazil. (p. 58).

▼ ▼ ▼

A unified promotion for fuel oil now appears assured with merger of Oil Heat Institute and the National Fuel Oil Council. Arrangements for the merger have now been drawn up. Only approval by the boards and membership remains.

Market Memo

Jan. 9, 1961

Second distillate price increase on East Coast within a month has added new zest to the nation's coastal markets.

Back of the move by Esso Standard is pressure from cold weather, lower stocks, and higher tanker rates on the Gulf-East Coast run.

Half cent a gallon increases were posted for kerosine, No. 2, and diesel fuels on the East Coast and 0.3 of a cent for same products at Baton Rouge and New Orleans. Esso increased price for No. 4 fuel by 4 to 16 cents a barrel and No. 5 by 14 to 16 cents a barrel. Light marine diesel fuels were advanced 21 cents a barrel and heavy marine diesel 10 cents.

New barge prices in New York harbor: 11.15 cents a gallon for kerosine, 10.15 for No. 2, and 10.55 for diesel. Net price remains a quarter cent off posting. Spot discounting in New England will continue at the higher price levels.

One chronic gasoline trouble spot was solved when Mobil increased dealer tank wagon prices in Rhode Island 0.9 of a cent to 14 cents a gallon for regular.

Other markets: On Gulf Coast, suppliers feel they can move some material to the East on heels of Esso advance if there is no increase immediately on the Gulf. No. 2 is now snug there at 8.5 cents. Feeling spreads that if 92-gasoline can hold near present 11.25 posting through January, it has fine chance of going into spring-buying season at good level. On both the River and Mid-Continent the distillates are holding well and gasoline shows little spot activity.

First price increase of motor oil in 4 years also has been made by Esso Standard. It put branded motor oils to its dealers up from 8 to 12 cents a gallon. Earlier price increases averaging around 10 cents a gallon were made by Sun, Shell, and Atlantic.

Ashland has adjusted its crude prices downward 5 cents a barrel in the Illinois basin and eastern Kentucky to meet the prices paid by competitors.

The new prices: $3 in the Indiana-Illinois basin and the Owensboro area: $2.87 for Somerset grade in eastern Kentucky; and $2.65 in the Greensburg area of Central Kentucky.

The premium price posted by Ashland became intolerable, the company says, because of increasingly stiff competition for product sales in Ashland's marketing area in the Great Lakes region. Ashland had kept the higher postings since late August but found the higher costs penalized it in getting the business of independent gasoline distributors.

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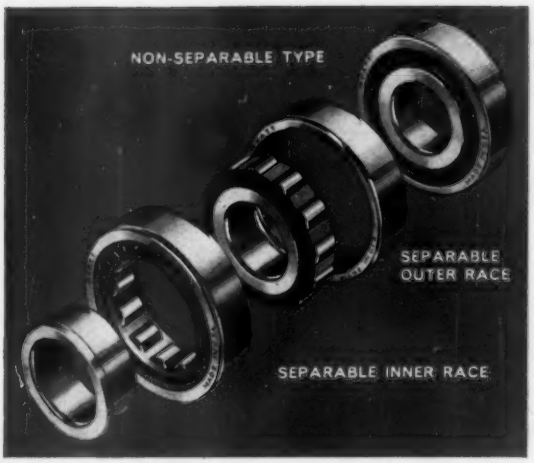

SERVICE

The fundamental difference in the service you get from one supplier or another can usually be traced to people.

HYATT has been fortunate to build an organization which contains the kind of people who make this difference apparent in the way that they make, sell and service Hyatt Bearings.

No one, for example, knows more about cylindrical bearings than Hyatt Sales Engineers. The experience and knowledge of these trained bearing specialists regularly save vital man-hours and dollars for customers in almost every kind of industry.

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Some call it service. Hyatt calls it people. You are urged to discover the difference in Hyatt people when you have a bearing problem. It's yours for the asking.

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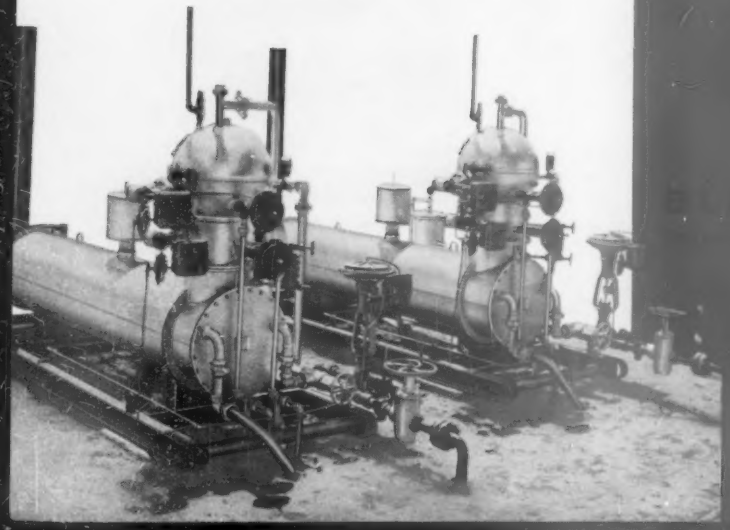
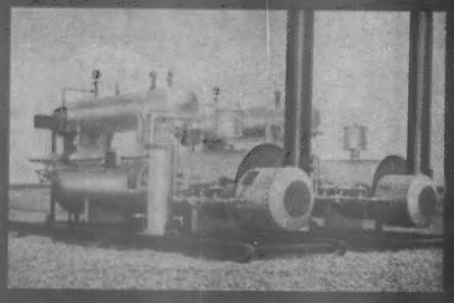
Free-O-F

FREE-O-FREEZ combines a spherical or horizontal separator and an indirect heater in one *automatic, compact, skid-mounted* unit. These units control bottom liquid temperature. BS&B's new Flash Arrestor gives maximum burner safety and eliminates possibility of flash-back. Variations of flow recorded on the gas chart are kept to a minimum by setting oil dump controls on throttling and water dump controls on snap. Snap acting water dump helps prevent freezing.

These spherical separator heater units each process 2 to 4 MMSCFD of gas with 18 bbls. of oil and 2 bbls. of water per MM. They have seen two hard winters. There were no freeze-ups. Displacement element for water dump is hung vertically, completely immersed in the liquid section, making for easier control of interface of oil and water. Submerged liquid section has sufficient area to warm the liquid in it, but there is little heat transferrence to upper gas section. Lower liquid is kept warm independent of sales gas temperature. Wellstream is preheated in the heater flow coil before choking to prevent hydrate formation in the separator.

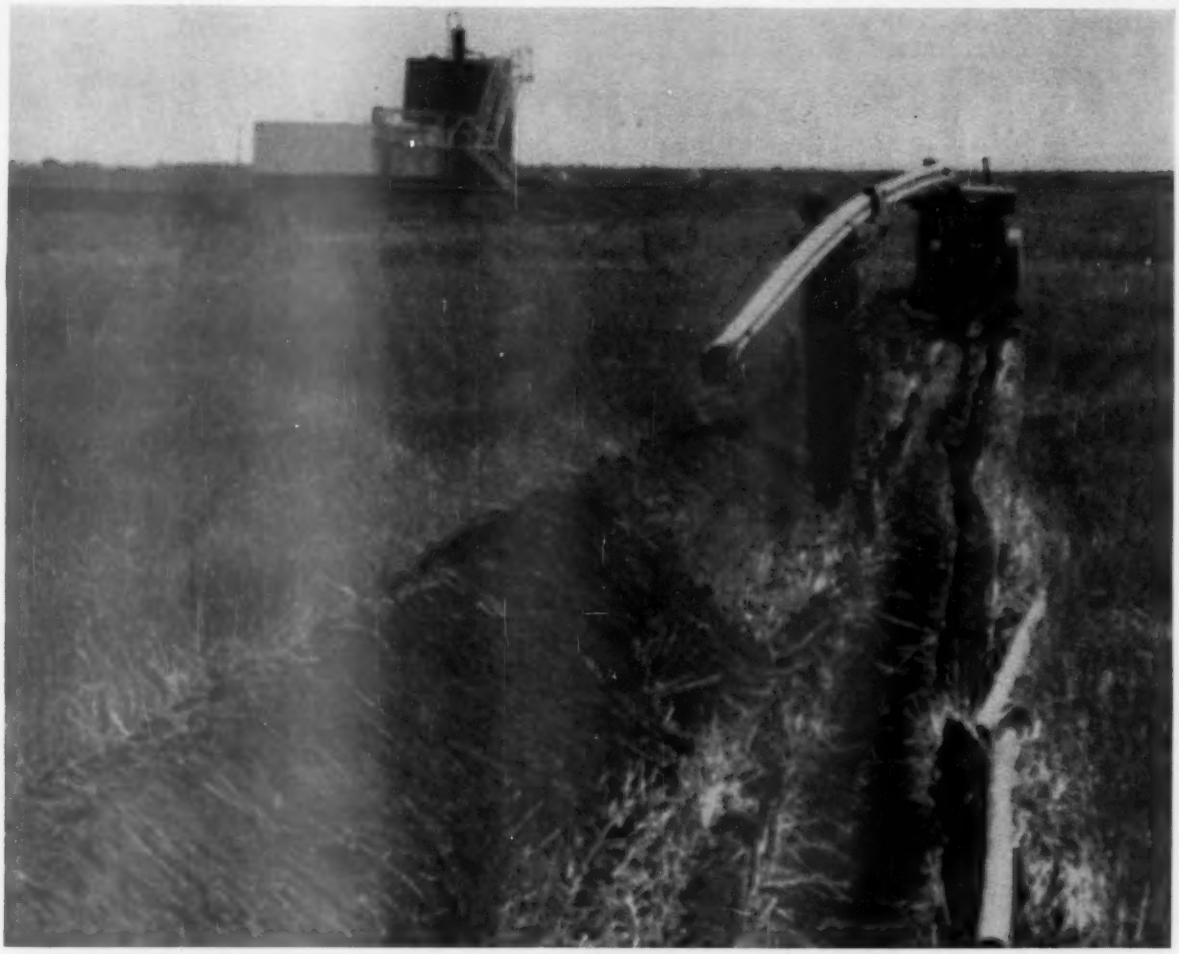


Prevents equipment freeze-ups, shut-downs and service calls



OVER 60 YEARS

BS&B



One man carries it, two men connect it

Koroseal PVC pipe is fast and easy to install—won't corrode, can't rust or rot, doesn't clog up

THOSE men are installing 1000 feet of pipe as a lead line between a new oil well and the tank battery. The pipe is Koroseal PVC—so light that one man carries five lengths of it without strain. So easy to connect that two men did the whole job in just a few hours.

Actually, it takes less than a minute for a two-man crew to get Koroseal pipe in position, apply solvent cement with a brush, and push two 20-foot sections together in a slipsleeve fitting.

But what makes Koroseal PVC pipe particularly ideal for oilfield use is its exceptional resistance to sour crude

oil, salt water, chemicals and corrosion. Bury it in the most severe acid or alkali soil, and Koroseal will not rust or deteriorate in any way. Its smooth internal surface reduces flow resistance, and virtually eliminates buildup of paraffin that clogs other pipes.

With all these advantages you might expect to pay more for a Koroseal pipe. But the fact is Koroseal costs less than standard steel pipe wrapped for corrosion protection. For full information on Koroseal PVC pipe, write *B.F.Goodrich Industrial Products Co., Dept. M-944, Akron 18, Ohio.*

Koroseal—T.M. Reg. U.S. Pat. Off.

Koroseal rigid PVC products by B.F.Goodrich

SPECIAL REPORT TO MANAGEMENT

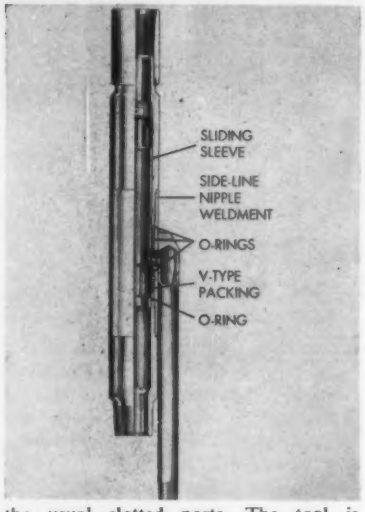
OTIS PRODUCTION NEWS

Volume II, Number 2 | **Otis Engineering Corporation • Dallas** | *Production Equipment and Services*

New Otis Cross-Over Tool Solves Zone Feeding Problem In Single String Dual Completions

Sliding Side-Door® With Special Weldment Provides Complete Zone Isolation With Cross-Over Chokes Out of Well

CORPUS CHRISTI — Another downhole completion and production problem has been solved by Otis Engineering Corporation with the development of a new type of cross-over tool. The new tool is essentially a Type A Otis Sliding Side-Door to which has been added a special one-inch pipe weldment on one side of the outer mandrel, in place of



the usual slotted ports. The tool is designed to be made up in the tubing with a short tubing sub and Type S Otis Landing Nipple above it and a tubing sub and Ported Landing Nipple below it, and then set in a dual or by-pass type packer. When installed with a Type SS Otis Plug Choke set in the ported nipple, the sleeve may be opened to permit production from the upper zone to be brought into the tubing through the one-inch pipe weldment while flow from the lower zone is directed into the annulus.

See schematic well diagram — right

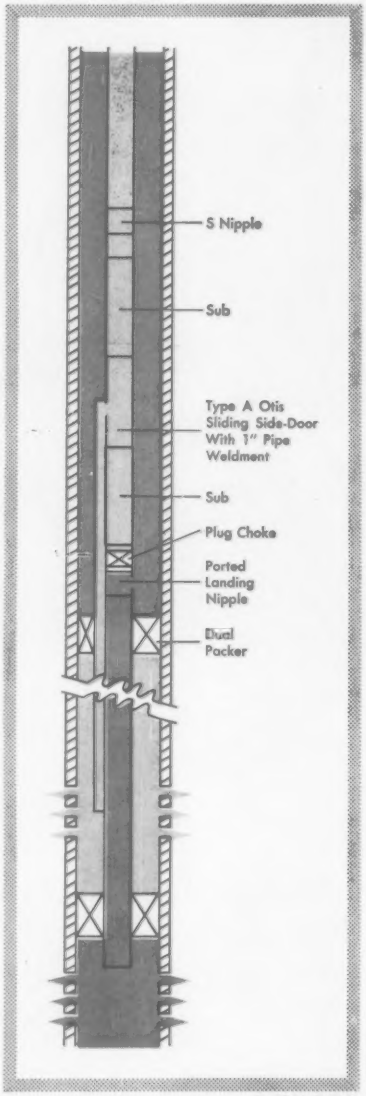
If desired, a straight flow choke may be landed in the assembly to permit production of the lower zone through the tubing while flow from the upper zone is produced through the annulus.

This new Otis Sliding Side-Door Cross-Over was developed at the request of a progressive Texas-based producing company which had experienced extended periods of lost production from the low pressure zones in its single string dual completions after changing a cross-over choke in conventional cross-over equipment, or when a choke had been out of the well for a short period of time for various types of wire line work. This loss of production proved to be the result of the high-pressure zone feeding the low-pressure zone.

According to the company, the new Otis Sliding Side-Door Cross-Over not only proved effective in solving its zone feeding problems, but it has also eliminated the need of having a pump truck on location to equalize pressure across the two zones — as was frequently necessary before the choke could be removed from conventional cross-over equipment. The company also reports it has successfully fractured the upper zone of a number of its wells through the one-inch pipe without damaging the tool.

The Type A Otis Sliding Side-Door, from which this new type of cross-over was derived, is a circulating and production tool which is used downhole to provide selective communication between the tubing and the annulus. The tool has a ported sleeve which is designed to be moved up or down within a ported mandrel. The sleeve may be shifted by one of two ways: 1) by standard wire line methods, or 2) by pumping down an expendable shifting tool. V-type packing and O-rings are used to provide a positive seal between the sleeve and the mandrel when the sleeve is closed.

The new Otis Sliding Side-Door Cross-Over is another example of the ingenuity of Otis' well completion specialists in the field and its engineering department in Dallas. Literally thousands of production problems of this nature have been solved by Otis over the past 32 years. For more information on the new Otis Sliding Side-Door Cross-Over, or for help with any specific production or completion problem, call the Otis office nearest you or write Otis, Dept. 2-W, Box 35206, Dallas 35, Texas. You will find your Otis specialist ready to help you — anxious to serve you.



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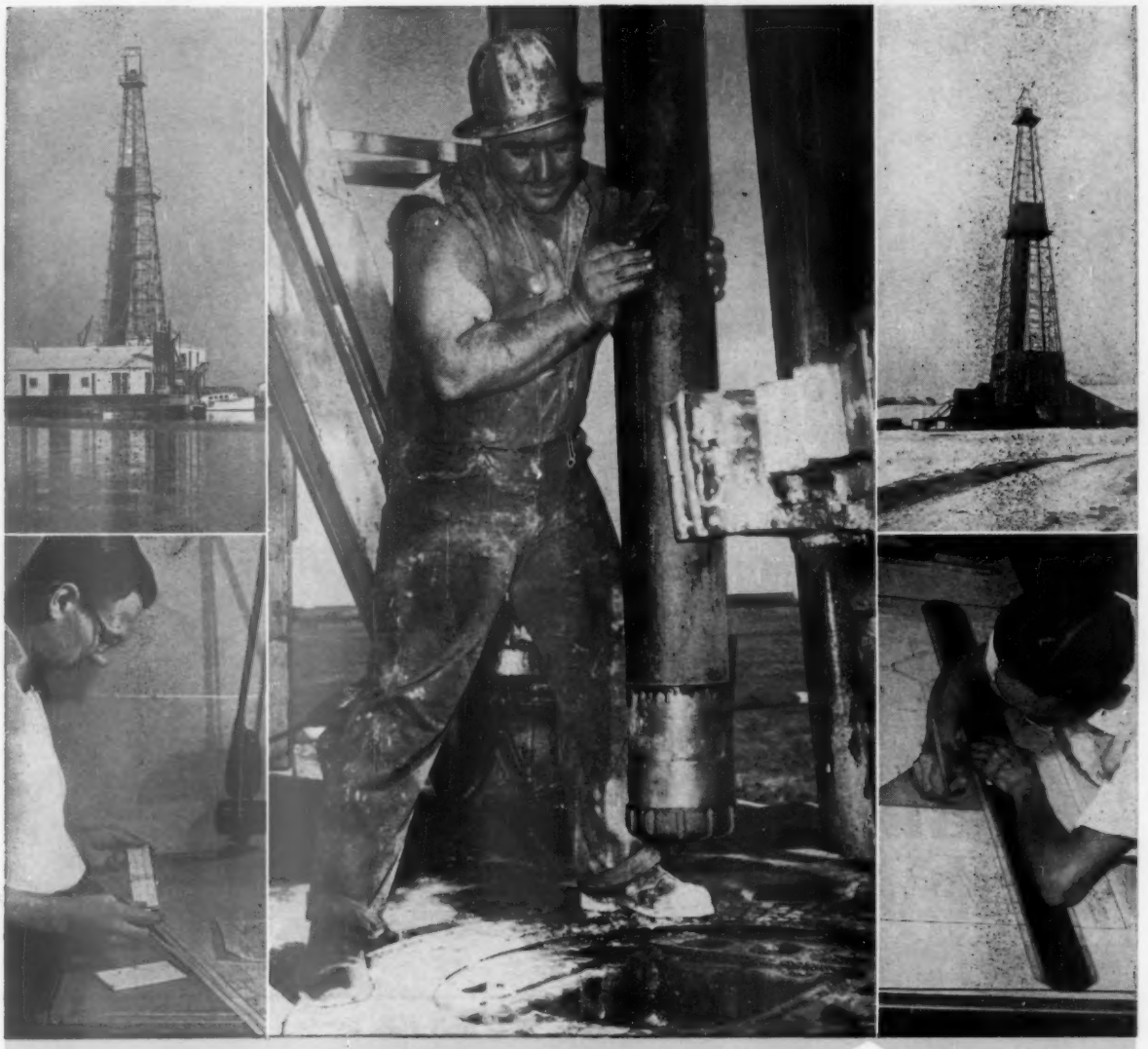

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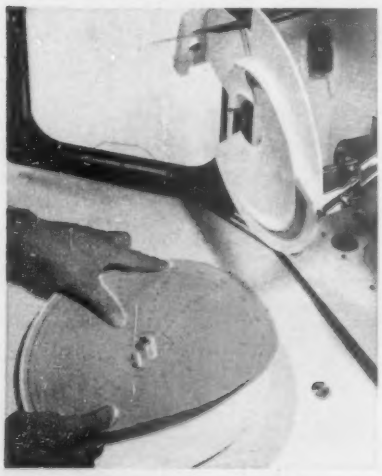
LOADING IS SIMPLE...



1. The Barton chart changer will hold up to 16 patented, split charts. A locating pin on the chart plate makes it virtually impossible to load incorrectly.

2. With the scroll assembly and the pens mechanically lifted and locked out of the way, the loaded chart plate is quickly mounted onto the chart drive shaft.

3. The scroll assembly and pens are lowered and locked into place. There is nothing to adjust, nothing to go wrong. Capillary pens are supplied by ink bottle inside the case.

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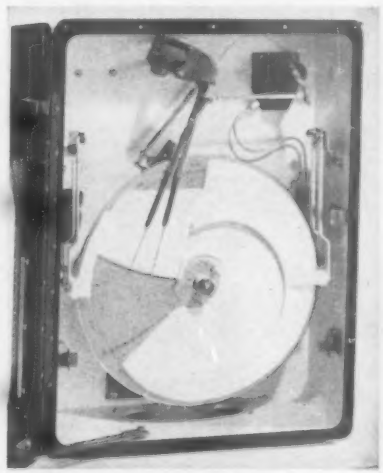
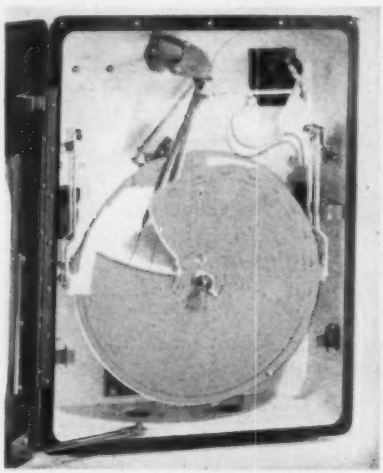
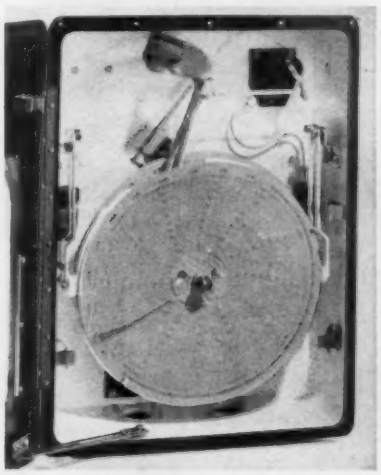


1. With the chart changer in position, the recorder is ready to operate. A portion of the chart (in green for illustration) shows from behind the scroll. Note the tab on the chart has just been picked up by the scroll knife edge.



2. As the chart drive rotates, the portion of the chart that has been recorded is spun onto the shaft and well away from the pens which are now recording on the last part of the chart.



3. The first chart has now completed its cycle and is held for storage on the shaft, clear of the pens, which are now recording on the newly exposed second chart. The pens begin recording on the new chart at the precise moment the first chart completes its rotation.

BEST TRACK... BIGGEST SAVINGS

Allis-Chalmers boosts work hours, cuts costs with the best tractor undercarriage in the business. You get industry's toughest track... best designed track guards ... certified, permanently lubricated truck wheels, idlers, support rollers.

Next time you watch track shoes squeal and grind against jagged rock . . . or see 'em buried sprocket-deep in mud, consider this: Nothing slugs it out with tough conditions like an Allis-Chalmers tractor undercarriage.

Specially heat-treated track shoes, side bars, track pins and bushings are the industry's toughest. Bushings extend into counterbored side bars to seal out dirt, provide more bearing area.

Track guiding truck wheel guards provide a deep-flanged guide channel that keeps track riding true on sprockets, idlers and truck wheels even in the roughest and toughest going. The solid A-frame holds the truck frames in absolute alignment — keeps track running straight.

PERMA-SAFE truck wheels, idlers and support rollers on all Allis-Chalmers tractors roll on tapered roller bearings, are protected against dirt and moisture by Positive Seals. Factory-lubricated, they're certified never to need further greasing.

We invite a maintenance cost comparison with any other tractor undercarriage. We further invite you to inspect the Allis-Chalmers healthy, long-lived tractor engine, the all-steel main frame, double-reduction final drives and many other cost-cutting features. Your Allis-Chalmers dealer will be happy to give you full details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Now available in Persian Orange or Allis-Chalmers Yellow at no extra cost.

move ahead with

ALLIS-CHALMERS

power for a growing world

FOLLOW THE FLOW

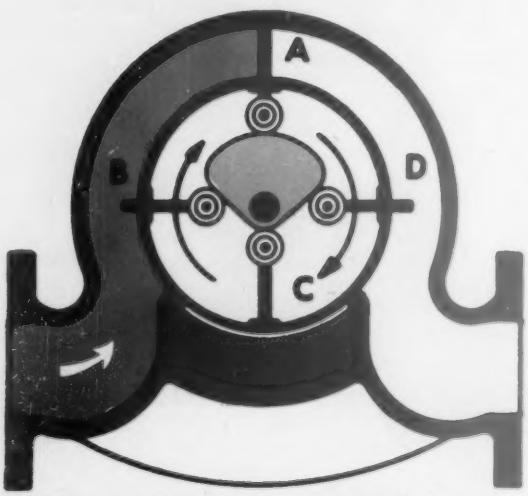
THAT LEADS TO ACCURATE, TROUBLE-FREE METERING

Unmeasured liquid (dark green) is shown entering meter. Rotor and vanes are turning clockwise. Vanes A and D are fully extended, forming the measuring chamber. Vanes B and C retracted.

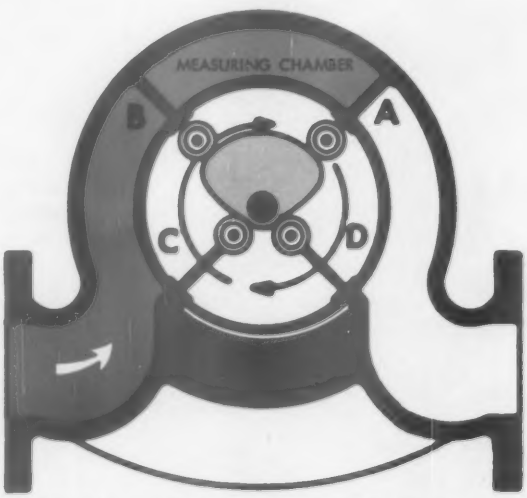
It's a matter of principle — the A. O. Smith Rotary Positive Displacement principle that results in the *simplest*, most *accurate* and *trouble-free* metering ever devised for petroleum products.

Let's take a look inside a typical Smith-Erie meter. What we see in these diagrams is a mechanism consisting of a free-running balanced rotor which carries four symmetrical vanes. As the rotor revolves on ball bearings around a central shaft, the vanes are positioned — moving with the fluid stream and dividing it into precisely measured segments of equal and exact volume.

Looks *simple* and it is. Frictional resistance is almost completely eliminated. Flow pattern is smooth and offers no resistance to streamlined flow. *Accuracy?* It's the most! Records show a consistent ability to retain accuracy for the longest periods of time, throughout the greatest flow range. And it's virtually *trouble-free*. Low pressure drop saves power and prolongs service



The rotor and vanes have made one-eighth revolution. Vane A is fully extended; Vane D is being drawn back; Vane C is fully recessed; Vane B is being extended.



A quarter revolution has been made. Vane A is still fully extended and Vane B is now fully moved out. An exact and known volume of new liquid is now in the measuring chamber.

life. Rotor speeds are held within conservative limits to assure long life and freedom from wear.

With such a simple, positive operating mechanism, it's no wonder Smith-Erie meters can be depended upon to provide uniformly high accuracy — day after day and year after year — under the most exacting service requirements.

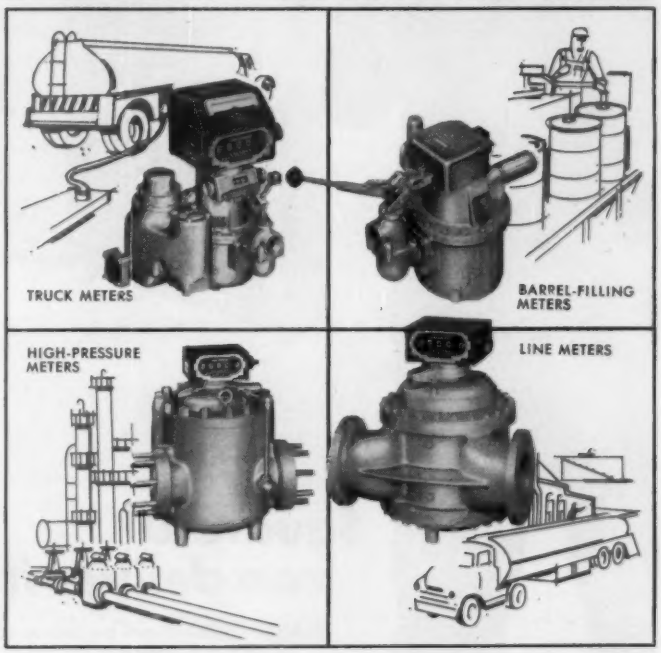
Through research ... *a better way*

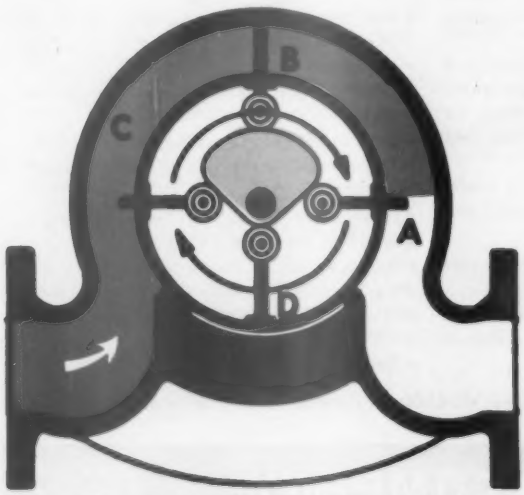
A.O.Smith
CORPORATION

Smith-Erie Division

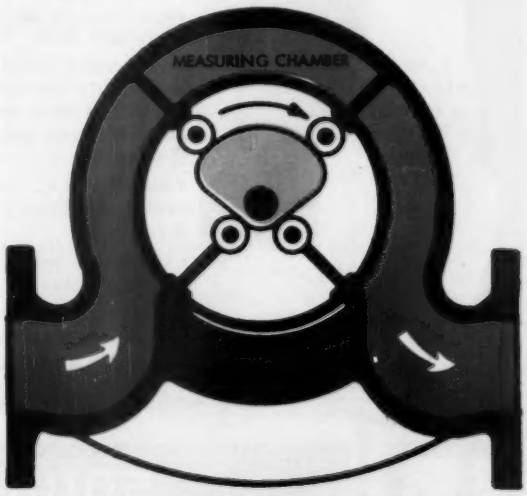
Factory: 1602 Wagner Ave., Erie, Pennsylvania. Offices: Atlanta 5, Ga.; Chicago 3, Ill.; Houston 2, Texas; Los Angeles 22, Calif.; New York 17, N.Y.; Newark, Calif.; Tulsa, Okla. Canada: Toronto 12, Vancouver 1. A. O. Smith INTERNATIONAL S.A., Milwaukee 1, Wis., U.S.A.

Rotary Positive Displacement Principle Is the Heart of All Smith-Erie Meters





One-eighth revolution later, the measured liquid is moving out. A second measuring chamber is beginning to form between Vanes C and B. Vane A is being drawn back.



In one-half revolution, two measuring chambers have formed and the third is forming. This cycle is repeated as long as liquid flows.

"What kind of Pumping Control do YOU need?"

Square D can deliver it from Stock!

BASIC PANEL can be tailored to fit your needs—

- NEMA Type 3 "weatherproof" enclosure protects against rain, sleet, hail, snow and dust.
- simplified installation—convenient knockouts for easy wiring, designed for either wall or pole mounting, or available with pedestal mounting feet if desired
- oversized enclosure permits field installation of additional features if required
- choice of fusible disconnect switch or circuit breaker
- HAND-OFF-AUTO selector switch
- available in ratings up to NEMA Size 4 to handle up to 100 hp

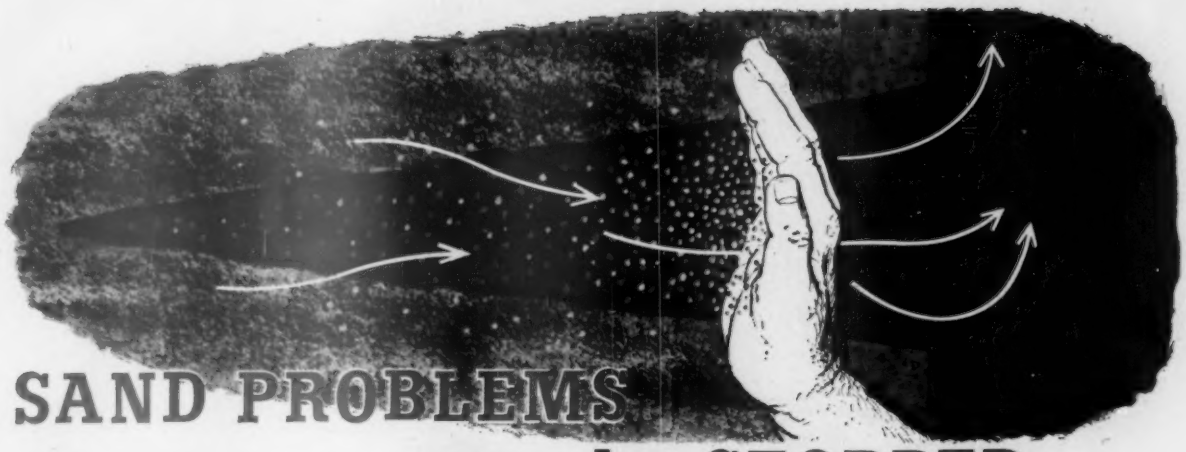
COMPLETE PROGRAMMING PANEL has every feature you need for oil well pumping—

- two types—one for operation up to 600 volts, another for 762-volt systems
- gasketed inner door isolates "live" parts—NEMA Type 3 enclosure gives complete weather protection
- overload relays in separate ventilated compartment to prevent nuisance tripping
- time clock has trip tabs for easy pumping program setup
- undervoltage release relay drops out on power failure, provides time-delay restart for staggered starting when power is restored
- built-in lightning arrester

Write for Bulletin 8944. Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

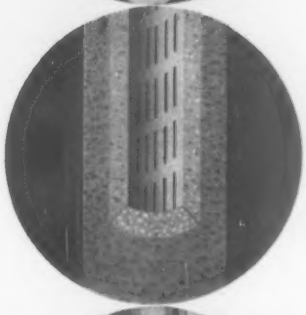
SQUARE D COMPANY

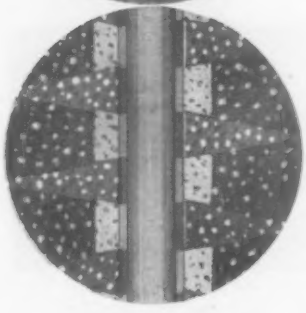
—wherever electricity is distributed and controlled



SAND PROBLEMS may be STOPPED

. . . with Halliburton Sand Control Methods!





SAND . . . spells *trouble!*

Halliburton's methods of Sand Control might spell an end to this trouble. How? By combating unconsolidated formation sand *at its source* — while it is still in the formation.

NEW HALLIBURTON SANCON

. . . is a multiple-stage chemical consolidating treatment especially for new wells. SANCON binds loose sand grains into a strong — yet permeable — structure. Downtime for a SANCON treatment is held to a minimum since the sand consolidation gains most of its strength within 10 minutes after placement. SANCON is not temperature sensitive.

NEW HALLIBURTON SANSET

. . . is another consolidation process. SANSET employs a pre-mixed plastic solution placed in one or two stages and allowed to react in the formation. Downtime is dependent on well temperature.

HALLIBURTON SAND SCREEN

. . . is a pre-formed liner that is very effective in almost any sand producing formation — new and old wells alike. Sand Screen consists of a slotted mandrel and a bonded outer layer of chemically inert, consolidated sand. This sand layer acts as a natural deterrent against the movement of formation sand into the producing equipment.

HALLIBURTON FRACPAC

. . . employs fracturing equipment and methods to place specially selected pack sand into the formation. The bridging action set up by Fracpac sand helps control the unconsolidated formation sand.

If loose formation sand is whittling away your profits let your Halliburton man explain his Methods of Sand Control.

FRACTURING SERVICES

275 Service Centers . . .
just minutes away from your well

Halliburton
COMPANY • DUNCAN OKLAHOMA

SAVE THE BEAN (and money)--throw the hole away!

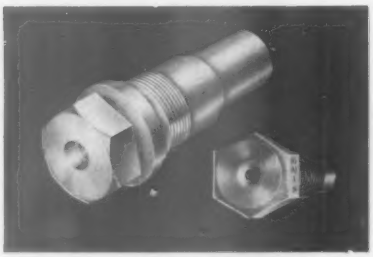
Specify UNIBOLT master beans and low-cost inserts

With ordinary care, a single UNIBOLT Master Bean will last for the entire flowing life of a well. These beans are threaded to receive an inexpensive screw insert. The cutting action of sand-laden production is imposed on the expendable insert, not the master bean.

The inserts are not only inexpensive, they are easier to change than regular beans. Drilled in increments of 5% and 10% of well flow, as well as in increments of 1/64th inch, these inserts provide the versatile range of an adjustable choke with the fine accuracy of a positive orifice.

This is only one of a number of refinements in flow bean design perfected and introduced by UNIBOLT. Others are: shaped entrance to reduce turbulence and maintain flow accuracy, "flow-rating" as a standard inspection procedure to insure correct orifice sizing, and special analysis alloys and heat-treatments for corrosion and wear resistance.

So, when you're thinking about Christmas trees, remember the UNIBOLT Positive Choke Bodies and Cage Nipples that let you save the bean, throw the hole away!

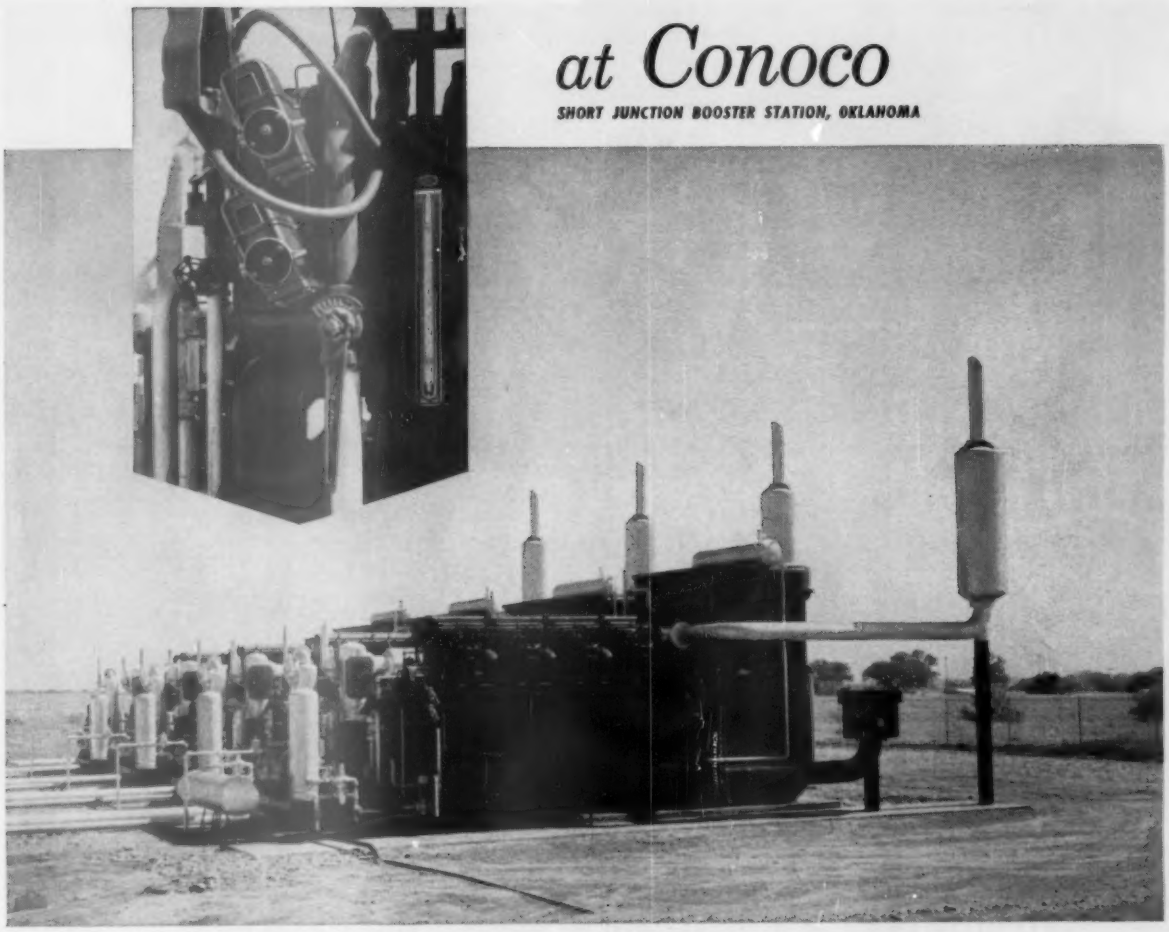


A Unibolt Master Bean and renewable, low-cost, insert.

UNIBOLT

THORNHILL CRAVER CO.

P. O. Box 1184, Houston, Texas



at Conoco

SHORT JUNCTION BOOSTER STATION, OKLAHOMA

BENDIX MAGNETOS HELP COOPER-BESSEMER ENGINES DELIVER DEPENDABLE, ECONOMICAL SERVICE

For many years Bendix ignition equipment has given dependable service in a wide variety of petroleum and natural gas applications. The Cooper-Bessemer gas engines, equipped with Bendix* LAR magnetos shown here, provide efficient, economical gas combustion to help move natural gas through the pipeline system at the Short Junction Booster station of Continental Oil Company in Oklahoma.

Bendix LAR magnetos provide reliable ignition at the lowest operating cost. Reserve power insures smooth running engines, even under the most adverse operating conditions. The Bendix LAR magneto and its companion Hi-V transformer coil are a matched ignition system that meets the most rugged engine requirements.

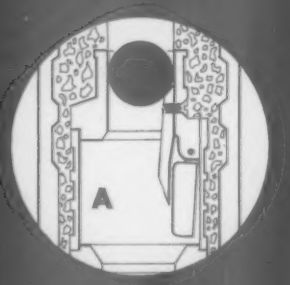
LA magnetos now in service can be easily converted to the modern Bendix LAR type with conversion kits now available. They can be obtained from your Bendix ignition distributor or from our factory. For complete details, write SCINTILLA DIVISION OF THE BENDIX CORPORATION, Sidney, New York.

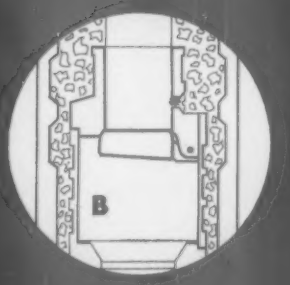
*REGISTERED TRADEMARK

Scintilla Division
SIDNEY, N.Y.

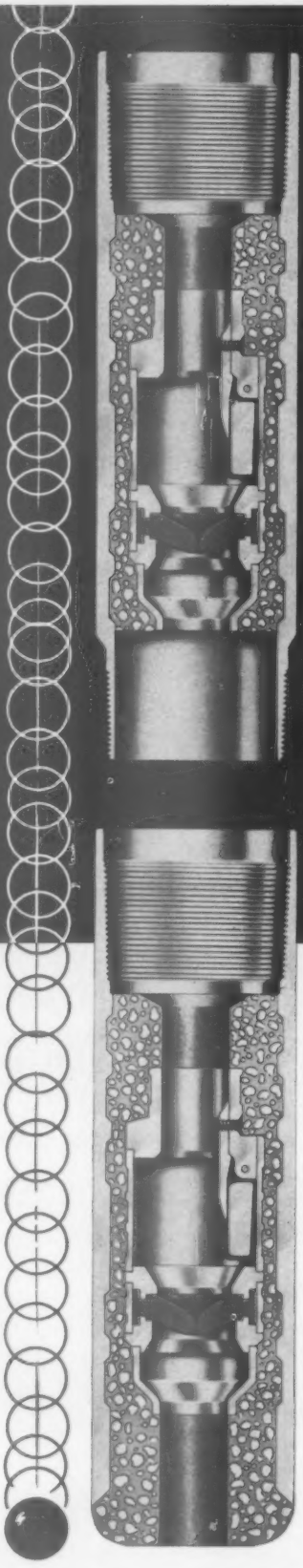
THE Bendix CORPORATION

NON-STOP TO BOTTOM





LARKIN CIRCULATING FILRITE CEMENTING EQUIPMENT



For automatically filling the casing from the bottom while casing is being run.

For allowing downward circulation through the casing at any time during the casing run.

Larkin Circulating Filrite Cementing Equipment makes possible a non-stop casing run without pressure surges but still permits full downward circulation when necessary.

The resilient diaphragm valve permits a continuous but restricted bottom-fill which is sufficient to maintain adequate casing fill without over-flow.

The flapper type valve is maintained in open position by an aluminum retaining bar which is held in place with a shear screw. The flapper valve is released by dropping a ball which shears the screw as it passes through the valve mechanism.

The flapper valve is spring loaded and provides a POSITIVE BACK PRESSURE SEAL WHICH HAS NO DEPTH LIMITATIONS.

LARKIN

...Through Your Supply Store

Circle A: A view showing dropped ball in shearing position.

Circle B: A view showing flapper valve in closed position after being released.

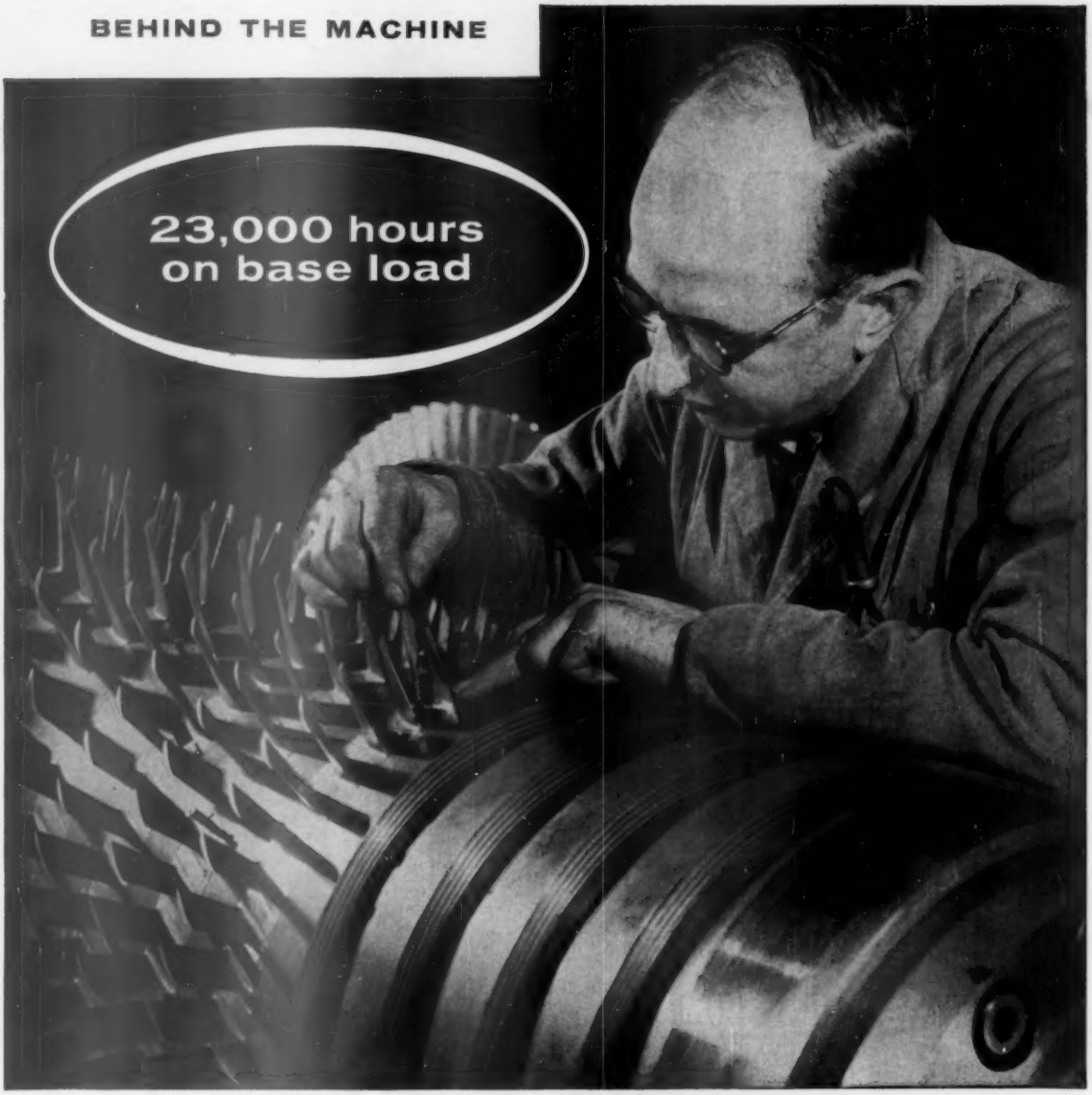
LARKIN PACKER COMPANY

DIVISION KOEHRING COMPANY

WAXAHACHIE, TEXAS

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

BEHIND THE MACHINE



The proved reliability of AEI industrial gas turbines is typified by a machine in Venezuela which has recently completed 23,000 hours running on base load. AEI makes a range of industrial gas turbines with ratings from 1,750 kW upwards designed to run on gaseous or liquid fuels.

The picture shows work on the compressor rotor of L2IC gas turbines being built, at the AEI Turbine-Generator Division Factory for the Basrah Petroleum Co. These feature a single shaft design which ensures stable regulation and makes them particularly suitable for parallel operation with other generating equipment.

This is a product of AEI Turbine-Generator Division, Britain's largest manufacturer of Turbine-Generators.

AEI Associated Electrical Industries Export Ltd
33 GROSVENOR PLACE, LONDON SW1

B/L002

Look to PARSONS FOR *PERFORMANCE*

OPERATING FLEXIBILITY

25 to 130%

OF DESIGN POINT

This sulfur plant recently completed for Trans-Jeff Chemical Corporation at Tilden, Texas, is capable of operating within the unprecedented range of 25 to 130 per cent of design capacity... while maintaining maximum over-all recovery of high purity sulfur, even from lean gas containing as little as 16 per cent H_2S.

PARSONS

THE RALPH M. PARSONS COMPANY
ENGINEERS CONSTRUCTORS / LOS ANGELES

DAYTON • HOUSTON • HUNTSVILLE • NEW YORK • PASADENA • WASHINGTON
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WORLD-WIDE SERVICES: PETROLEUM-CHEMICAL ENGINEERING • ARCHITECT-ENGINEERING • POWER PLANT ENGINEERING • CONSTRUCTION • ELECTRONIC SYSTEMS AND COMPONENTS • WATER DEVELOPMENT AND SYSTEMS • APPRAISALS AND ECONOMIC STUDIES • PLANT OPERATION • PERSONNEL TRAINING

NIGHT AND DAY

twenty-four hour service

PUMPS • WATER WELLS • WATER TREATMENT

Layne knows that an unfailing supply of water is vital, whether it be for municipal, industrial or agricultural use. With Associate Companies located throughout the world, Layne can provide the speed, the trained technicians and the quality parts to remedy your water problem. Over 75 years of experience accounts for the ever increasing list of customers who depend on Layne for service. For service night and day, call the Man From Layne.

Write for Layne Service Bulletin 100.

LAYNE OFFERS COMPLETE WATER SERVICE: Initial Surveys • explorations • recommendations, site selection • foundation and soil-sampling • well drilling well casing and screen • pump design, manufacture and installation • construction of water systems • maintenance and service • chemical treatment of water wells water treatment—all backed by Layne Research. Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.

LAYNE & BOWLER, INC., MEMPHIS

General Offices and Factory, Memphis 8, Tenn.

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

SALES REPRESENTATIVES IN MAJOR CITIES

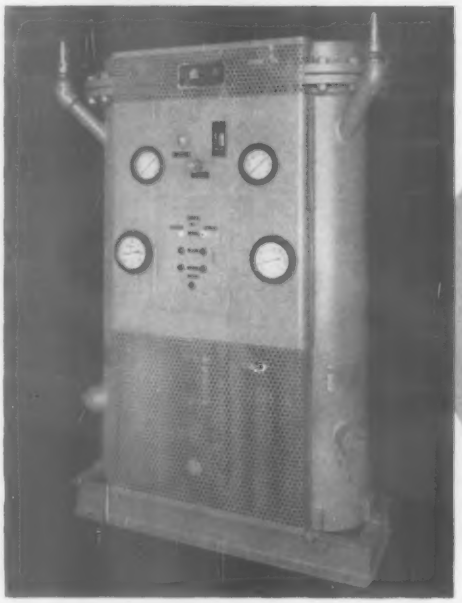
KEMP ORIAD DESICCANT DRYERS

stop moisture best, cost less 3 ways!

1 Complete reactivation
An exclusive 3-zone embedded-heater design gives every KEMP ORIAD DESICCANT DRYER unmatched extra-drying power. Reactivation is always complete and uniform in *any* drying process of air, gases or liquids, assuring maximum desiccant capacity—minimum dew-point performance.

2 Perfect temperature control Heat input is conserved by thermostatic control . . . ideal temperatures are maintained for the highest operating efficiency at the lowest operating costs. An alarm system guards the entire network.

3 Full automatic operation A simple setting of the program timer, and everything is automatically regulated. Drying results with the least pressure loss, lowest operation and maintenance cost. For further details, write for Bulletin D-103 . . . or call your local Kemp Man listed in the Chemical Engineering Catalog.



It always pays to come to

KEMP OF BALTIMORE

THE C. M. KEMP MANUFACTURING CO.
405 E. Oliver Street • Baltimore 2, Maryland

Armco Casing...

for String of Strength

Rugged Armco Casing gives you the strength you want and need in surface casing. It can save you money, too. Tests show that the variation in collapse resistance for Armco Casing is less than for other types. Because this high collapse resistance is uniform throughout, lighter and lower-cost strings can be set to greater depths.

Other cost-saving features of Armco Casing include: (1) fast field welding—the easy-to-make downhand fillet weld is all that's required; (2) reduced running time—exact 40- or 50-foot lengths mean fewer joints in the string.

Armco Casing, ranging in size from 6 to 24 inches, is distributed by National Tank Company. For complete information, mail coupon.

Steel
Strong
Durable
Economical

ARMCO DRAINAGE & METAL PRODUCTS INC.
4191 Curtis St., Middletown, Ohio

Send me more information about Armco Casing.

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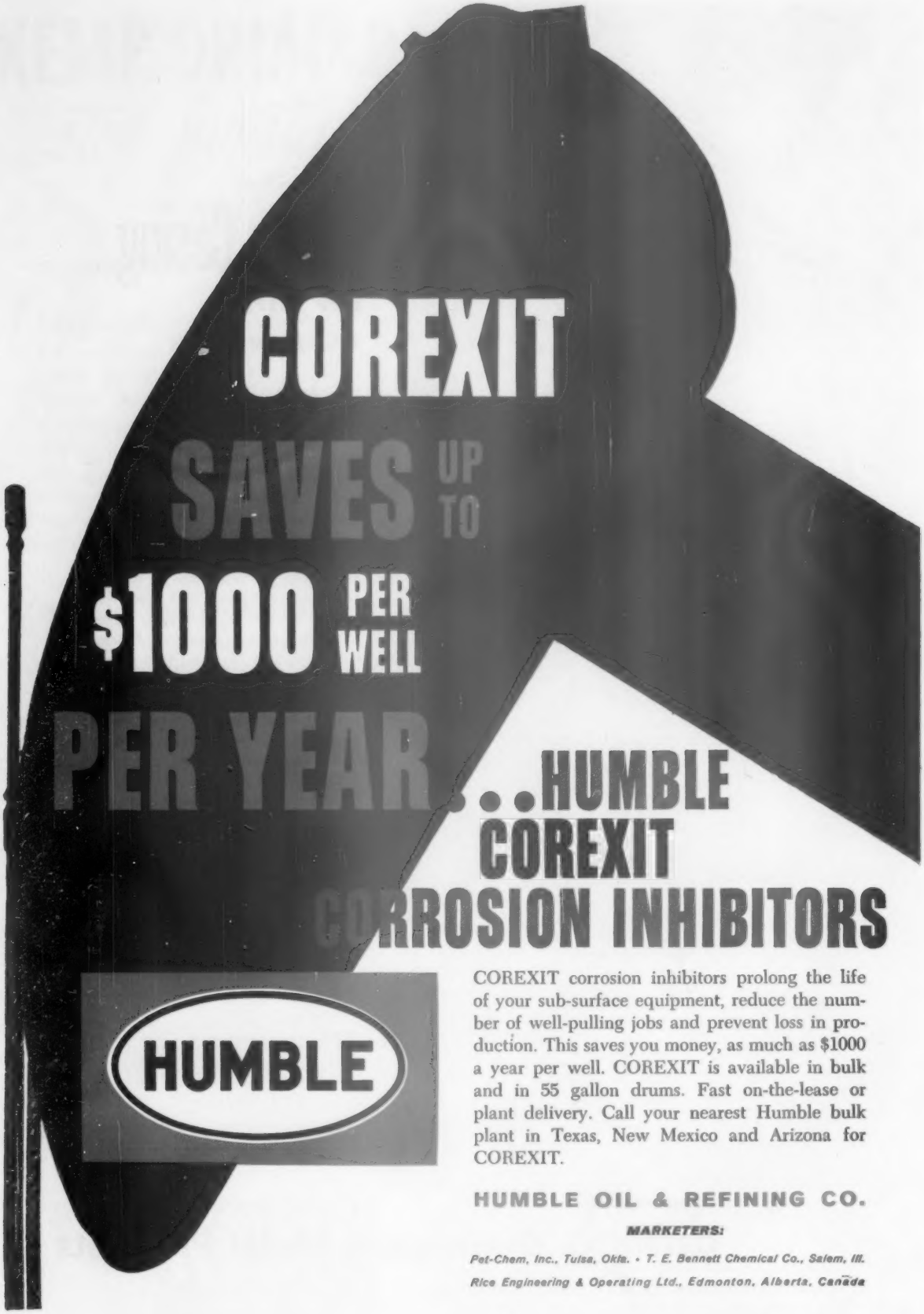
ARMCO Drainage & Metal Products



COREXIT corrosion inhibitors prolong the life of your sub-surface equipment, reduce the number of well-pulling jobs and prevent loss in production. This saves you money, as much as $1000 a year per well. COREXIT is available in bulk and in 55 gallon drums. Fast on-the-lease or plant delivery. Call your nearest Humble bulk plant in Texas, New Mexico and Arizona for COREXIT.

HUMBLE OIL & REFINING CO.

MARKETERS:

Pet-Chem, Inc., Tulsa, Okla. • T. E. Bennett Chemical Co., Salem, Ill.

Rice Engineering & Operating Ltd., Edmonton, Alberta, Canada

Arkansas Drilling Costs Cut With ATLAS EMULSIFIER

$6,843 Saved in 3900' Comparison

Following the operator's success in drilling with Atlas Emulsifier in Mississippi, Arkansas Fuel Oil Corporation and Montgomery Drilling Company pioneered the use of these drilling fluids in Columbia County, Arkansas. A direct comparison of their recently drilled Deltic Farms and Timber Company No. 1 with Arkansas Fuel's nearby Murphy No. 1 demonstrates the economy of utilizing Atlas oil-in-water emulsion muds. Murphy No. 1 was drilled a year earlier with a gel mud program typical of the Columbia County area. Even with the disadvantage of smaller equipment, the comparison interval was drilled in seven fewer days. Also, nine less bits were used to drill equivalent footage. Taking a rig cost of $900 per day and bit costs of $235 each, the savings total $8,415. Adjusting for the difference in mud bills (including diesel oil in the emulsion) the well shows a net saving of $6,843. Fewer days on the well often cut costs other than those noted above. In the case of Deltic Farms and Timber Company No. 1, 5½ fewer days to go from 6,200' to TD made possible the earlier release of a logging unit and an additional saving of $165 a day.

DRILLING RECORD COMPARISON

	Deltic Farms & Timber Co. No. 1	Murphy No. 1
Mud	Trimulso Emulsion	Gel Mud
Interval	4812 - 8780	4971 - 8761
Feet Drilled	3968	3790
Drilling Days	24	31
Feet per Day	165	122
Drill Pipe	4"	4½"
Drill Collars	15	15
Pumps	1 - 6½ x 16	1 - 6 x 20
Bits	31	40
Feet per Bit	125	95
Weight on Bit	30 - 35,000	35,000
Liner Sizes	6½"	6"
Mud Cost	$5,520	$5,398
Oil Cost	$1,450	0

$6,843 saved

Atlas emulsifier is sold through distributors under these tradenames . . . each is the product of Aquaness Department, Atlas Powder Company:

TRIMULSO®

Distributed by Baroid Division, National Lead Company

Registered trademark Baroid Division, National Lead Company

DRILLING MILK

Distributed by Magnet Cove Barium Corporation

Registered trademark Magnet Cove Barium Corporation

Drilling Milk
A SPECIAL EMULSIFIER FOR CLEAR WATER DRILLING AND LOW SOLIDS FLUIDS
MAGNET COVE BARIUM CORP.
HOUSTON, TEXAS

ATLOSOL

Distributed by Milwhite Mud Sales Company and other selected mud companies

Registered trademark Atlas Powder Company

ATLAS EMULSIFIERS IMPROVE A GOOD DRILLING FLUID

Because Atlas oil-in-water emulsion muds provide better oil action, they improve hole conditions, extend bit life, and increase penetration rates.

Better Hole Conditions. Atlas oil emulsion decreases torque as much as 50% . . . the hole is kept cleaner and pump pressures are correspondingly lower. There is less danger in lost-circulation and low-pressure zones.

Longer Bit Life. Atlas oil emulsion prevents balling, provides better cutter and bearing lubrication. Greatly extended bit life reduces bit costs, reduces rig hours lost to trip time.

Faster Drilling Rates. Atlas oil emulsion makes more feet of hole per hour. Oil lubrication combines with improved hole condition to increase drilling rates in competent and troublesome formations.

ATLAS Aquaness CHEMICALS ATLAS POWDER COMPANY

Aquaness Department, Atlas Powder Company
P. O. Box 21072 • Houston 26, Texas

127

This is one of many LIGHTNIN Mixers blending fuel oils and gasoline at the Cities Service Trafalgar Refinery near Toronto, Canada.

How to turn over 90,000 barrels —without spilling a cupful

At the flip of a switch, this 25-hp LIGHTNIN Mixer starts a slow but powerful ripple of gasoline surging across the tank's bottom and up the opposite side.

Not long afterward, the entire 90,000 barrels of product in the tank are moving in a steady blending pattern. From then on, every gallon of liquid drawn from the tank will test the same as every other gallon.

The maintenance man doesn't need to worry about packing or tightening a stuffing box on this mixer. There isn't any stuffing box. Instead, a rotary mechanical seal that he never has to adjust holds the product where it belongs, without a leak.

If necessary, the seal can be replaced *in minutes*—without dismantling or removing the mixer, even under a full head of liquid in the tank.

This seal, optional on all LIGHTNIN Side Entering Mixers, is helping refiners everywhere reduce maintenance costs and shutdown time. It's only one example of the advanced thinking and up-to-date engineering you get when you choose LIGHTNIN Mixers for your big tanks.

To learn more about this cost-cutting kind of mixing, call in the LIGHTNIN Mixer man in your area. He's listed in Refinery Catalog and in the yellow pages of your telephone book. Or write directly to us.

Lightnin® Mixers

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 174-a Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.

In Europe: Lightnin Mixers, Ltd., Poynton, Cheshire, England

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They Say—

Improvement to continue

"While the American economy has slackened somewhat, prospects for the oil industry during 1961 are for a continuation of the improvements shown during the last half of 1960.

"The product balance picture has improved materially with a much better relationship existing between demand and production and refining than was evident early last year.

"Nationally, civilian domestic demand for motor gasoline should show gains in both 1960 and 1961.

"On the West Coast, demand for this product in 1961 should show about the same 3½% increase it evidenced during 1960.

"Contrary to general economic trends petroleum demand in the United States should show slight gains in the year to come."

T. S. Petersen, president, Standard Oil Co. of California.

Editor's note: The exclusive year-end statement above and those that follow were not included in the Journal's December 26 report (p. 75) because of an early publication deadline.

Restraint still needed

"Presently the oil industry is acquitting itself very satisfactorily in handling the imbalance between demand for products and refinery runs. Prospects appear good for continuing restraint, which must be exercised by top management.

"Exploration and production will continue to be good business throughout 1961 and during the foreseeable future because energy demands are increasing.

"Posted field prices for crude oil should remain firm at around current levels throughout 1961, and field prices for natural gas should continue improving in spite of the resistance of regulatory agencies.

"Natural gas is going to sell during 1961 at prices more nearly approaching the cost to consumers of competitive fuels, chiefly petroleum products.

"The trend towards expanding the territories in which a number of re-

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fining companies market their products will continue without abatement during 1961, but, in my opinion, without the disregard for profits that has accompanied some expansions over the past year.

"Earnings of oil companies next year are likely to be higher—from 5% to 10%—even though demand for products increases by no more than 2% or 3%.

"Already announced and pending increases in salaries and wages are substantial additions to costs, but will be more than offset with economies to be accomplished through reorganization and greater automation."

R. L. Tollett, president, Cosden Petroleum Corp.

Profits will hold up

"An increase in demand of 2.5% over 1959 and improved product prices enabled the oil industry to make a comeback in 1960. Continued restrictions on both domestic production and on foreign imports helped to reduce the nation's inventories of crude oil, thus giving additional strength to petroleum markets.

"It is reasonable to expect a continuation of these favorable conditions in 1961.

"We estimate that domestic demand for all petroleum products will increase some 2.4% next year.

"As for some of the specific products, sales of motor gasolines are expected to rise about 2.6%. Demand for distillates may be only 1.8% greater than in 1960 and restricted supplies of residual fuel may hold consumption of that product some 2% below the 1960 level.

"Aviation gasoline requirements, which fell nearly 20% in 1960, will continue to decline, but this loss will be more than offset by rapidly expanding markets for jet fuel for commercial aircraft.

"The domestic oil industry is expected to enter 1961 with crude-oil inventories of only 235 million barrels, some 20 million less than previously believed were needed. Therefore, further reductions in inventory seem unlikely, so that most of the increase in demand will have to be met by a higher rate of domestic production.

"We estimate that production will need to average 7,270,000 bbl. per

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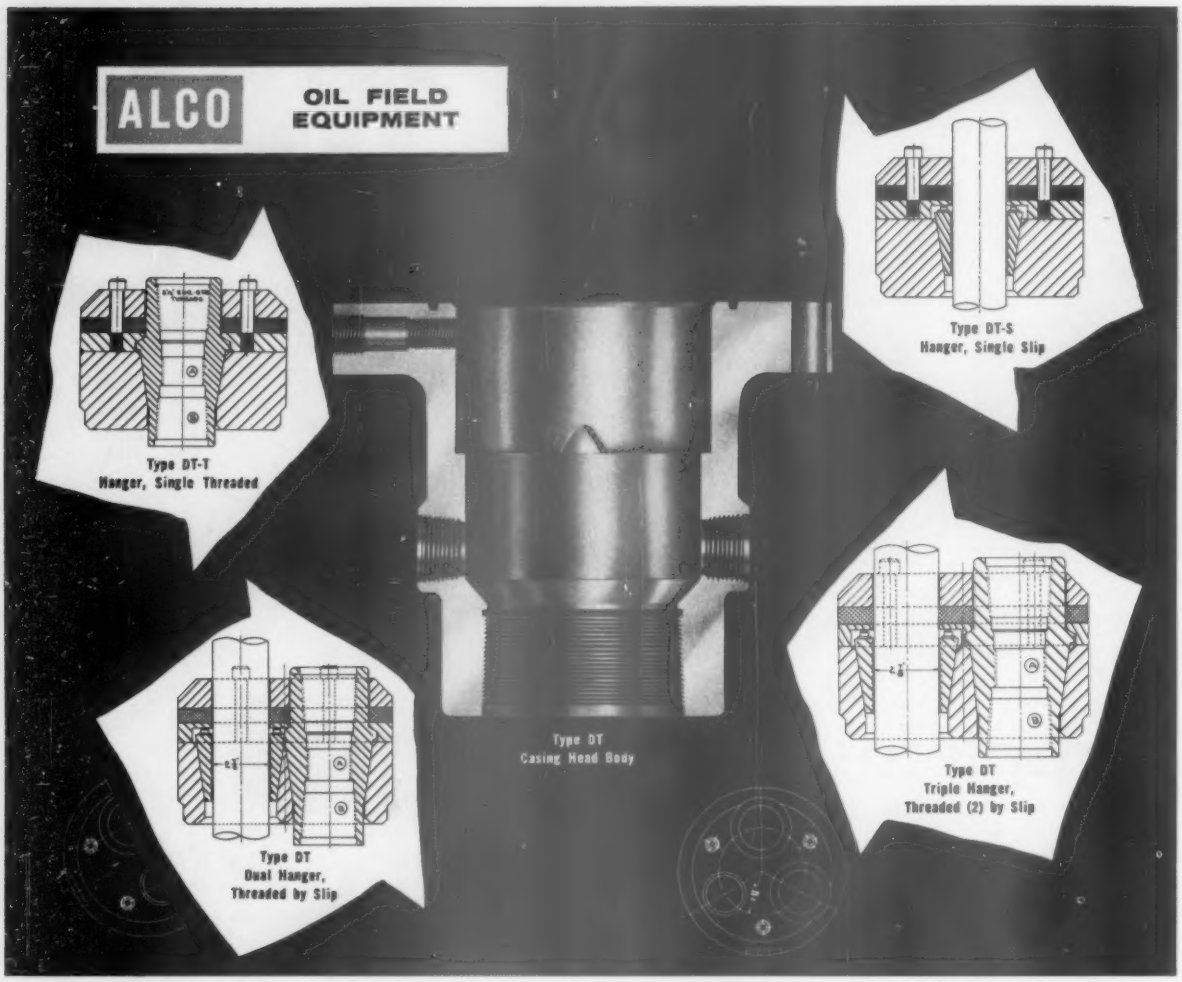

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day, nearly 300,000 bbl. per day more than in 1960. This increase should be enough to arrest the downtrend in Texas producing days.

"Although crude-oil inventories are currently in better balance, stocks of gasoline and distillates are somewhat excessive. With supplies of crude oil continuing to be limited, product stocks may be reduced to desirable levels early in 1961. In this event, refineries will need to operate at a rate some 3% higher than in 1960.

"Considering all of these factors, the outlook for the oil industry in 1961 is favorable, and I believe that we can expect profits to be at least as good as they were in the past year."

Henderson Supplee, Jr., president, Atlantic Refining Co.

A note of cautious optimism

"During 1960 the oil industry has made substantial progress toward learning how to live with too much capacity. Crude stocks have been cut down to healthy levels, and product prices have been kept at levels which, while too low for reasonable profits, are still above distress dumping. There are grounds for optimism concerning 1961, providing we halter hope with caution.

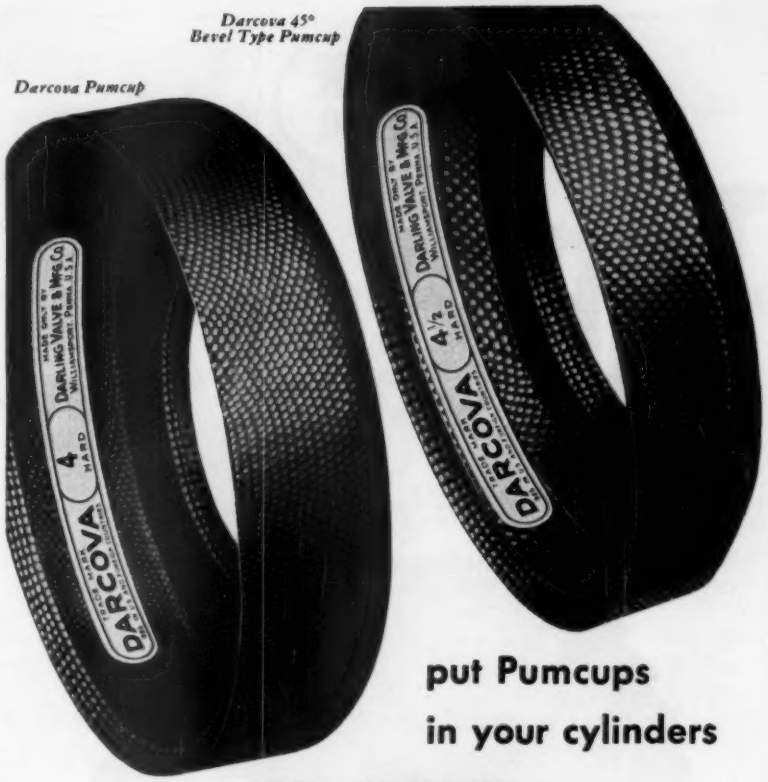
"Caution is also dictated by the fact that the growth in demand for 1960 now seems likely to prove out at something less than 2%, compared to demand growth percentages of 4, 5, or 6% for almost every other year since the end of World War II.

"At Gulf, earnings of $237,910,000 for the first 9 months of 1960 were 10% above the same period of 1959, and all indications are that the year's closing months will follow this pattern. This increase in earnings is largely attributable to increased domestic production, and increased sales of natural gas and petrochemicals.

"Gulf has projected capital expenditures for 1961 of around $385,000,000, or 10% above the 1960 figure. A substantial portion of this will go for enlarged petrochemical capacity."

W. K. Whiteford, chairman, Gulf Oil Corp.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.



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JANUARY

13 Southern Gas Association, research and development roundtable conference, Paso del Norte Hotel, El Paso, Tex.

15-16 Oklahoma Independent Petroleum Association, annual meeting, Mayo Hotel, Tulsa.

15-18 Pipe Line Contractors Association, annual meeting, Mark Hopkins and Fairmont Hotels, San Francisco.

16-19 Instrument Society of America, winter instrument-automation conference and exhibit, Sheraton-Jefferson Hotel and Kiel Auditorium, St. Louis.

17-19 Kentucky Petroleum Marketers Association, annual meeting and convention, Brown Hotel, Louisville.

18 Institution of Mechanical Engineers (Great Britain), symposium on pressure vessel research toward better design.

19-20 API Committee on Public Affairs, Los Angeles regional conference on employe communications, Statler-Hilton Hotel, Los Angeles.

20 Natural Gasoline Association of America, Gulf Coast regional meeting, Robert Driscoll Hotel, Corpus Christi, Tex.

20-21 Association of Oilwell Servicing Contractors, fifth annual convention, Dallas.

22-24 Kansas Oil Men's Association, annual convention, Broadview Hotel, Wichita.

24-27 Society of Plastics Engineers, seventeenth annual technical conference, Shoreham Hotel, Washington, D. C.

25-27 Texas A & M College, sixteenth annual symposium on instrumentation for the process industries, College Station, Tex.

26-27 American Chemical Society, Southeastern Texas Section, fourth symposium on hydrocarbon chemistry, Shamrock Hilton Hotel, Houston.

30-Feb. 9 University of Illinois, annual quality control short course, Urbana, Ill.

FEBRUARY

2 Petroleum Equipment Suppliers Association, south Mid-Continent district meeting, Statler Hotel, Dallas.

7 Petroleum Equipment Suppliers Association, Gulf Coast district meeting, Shamrock-Hilton Hotel, Houston.

7-8 University of Oklahoma, School of Petroleum Engineering, advanced petroleum engineer seminar, University of Oklahoma, Norman.

8-10 Southwestern Legal Foundation, twelfth annual institute on the law of oil, gas, and taxation, Southwestern Legal Center, Dallas.

9-10 API Committee on Public Affairs, New Orleans regional conference on employe communications, Roosevelt Hotel, New Orleans.

9-11 National Society of Professional Engineers, winter meeting, Hotel Fort Des Moines, Des Moines, Iowa.

14 Petroleum Equipment Suppliers Association, eastern district meeting, Duquesne Club, Pittsburgh.

14-15 National Association of Corrosion Engineers, Shreveport, La., section, short course, Centenary College, Shreveport.

15-16 Western Petroleum Refiners Association, Gulf Coast regional technical-industrial relations meeting, Rice Hotel, Houston.

16 API Committee on Public Affairs,

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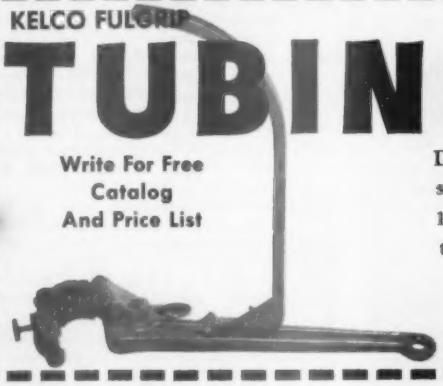

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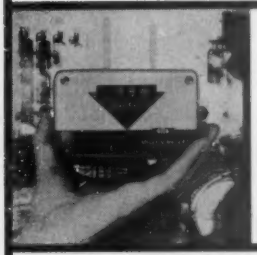

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18 Purdue University, business history conference, "Management Decisions Under Government Regulation," Memorial Union, Purdue University, Lafayette, Ind.

20-Mar. 11 Advanced Drilling Practices Course for Engineers, University of Oklahoma, Norman.

23-24 Oklahoma State University, natural-gas conference, Stillwater, Okla.

24 Natural Gasoline Association of America, South Louisiana regional meeting, Lafayette Petroleum Club, Lafayette, La.

26-Mar. 1 American Institute of Chemical Engineers, petrochemical and refining exposition, Municipal Auditorium, New Orleans.

26-Mar. 2 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual meeting, Chase and Park Plaza Hotels, St. Louis.

28-Mar. 1 API Committee on Public Affairs, New York regional conference on employe communications, Park-Sheraton Hotel, New York City.

MARCH

2 Petroleum Equipment Suppliers Association, north Mid-Continent district meeting, Mayo Hotel, Tulsa.

3 Ohio Oil and Gas Association, winter meeting, Deshler Hilton Hotel, Columbus.

5-9 American Society of Mechanical Engineers, gas-turbine power division, and U. S. Department of Defense, annual gas-turbine conference and products show, Shoreham Hotel, Washington.

7 Petroleum Equipment Suppliers Association, Pacific district meeting, Ambassador Hotel, Los Angeles.

7-8 University of Oklahoma, School of Geological Engineering, seventh biennial geological symposium, Student Union Building, University of Oklahoma, Norman.

8-9 API Committee on Public Affairs, Chicago regional conference on employe communications, Sheraton-Towers Hotel, Chicago.

8-10 American Petroleum Institute, Division of Production, southern district meeting, Captain Shreve and Washington-Youree hotels, Shreveport, La.

13-16 Kentucky Petroleum Marketers Association, sixth management institute, conducted by the University of Louisville, Brown Hotel, Louisville.

13-17 National Association of Corrosion Engineers, annual meeting and corrosion show, Hotel Statler, Buffalo, N. Y.

15-17 Natural Gasoline Association of America, annual convention, Baker Hotel, Dallas.

16-17 International Oil and Gas Educational Center, study of the economics of petroleum exploration, development, and property valuation, Southwestern Legal Center, Dallas.

21-23 American Power Conference, twenty-third meeting, Sherman Hotel, Chicago.

22-24 American Petroleum Institute, Division of Production, southwestern district meeting, Cole Hotel, Albuquerque.

23 National Industrial Conference Board, general session, Shamrock-Hilton Hotel, Houston.

27-29 Midwest Gas Association, annual meeting and convention, Sheraton-Fontenelle Hotel, Omaha.

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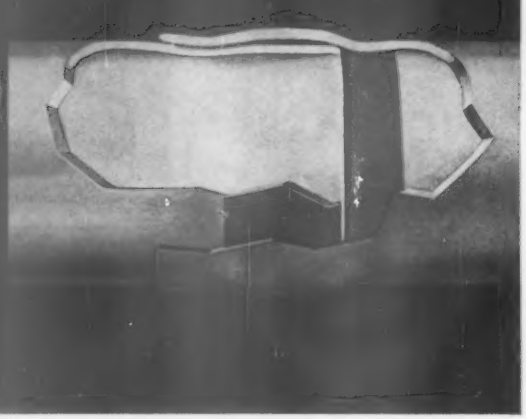

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The pipe is flared to a bell shape on one end to receive the plain end of another pipe length. Contact surfaces are coated with an epoxy adhesive before they are joined. A patented tool then crimps the joint, providing mechanical strength while the epoxy sets. The pipe can be laid immediately.

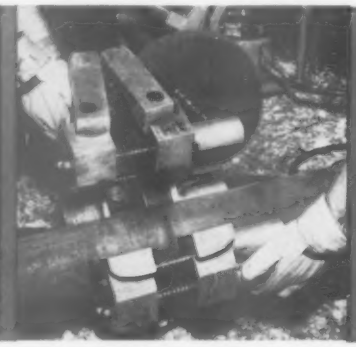
Field tests over a 12-month period have proved the advantages of this new method. It has joined line pipe rapidly and permanently, providing a plastic-lined joint that *prevented internal joint corrosion.* The high-strength, lightwall pipe has substantially reduced material costs. Installation time and costs have also been reduced because welding operations were eliminated.

Recently TEX-TUBE EPOXY-JOINED pipe was used to lay a 20,000-foot, 4-inch gas line. Pipe costs were 58 per cent lower than the cost of conventional pipe. Installation costs were also reduced 25 per cent and installation time was about half that required for welded-joint pipe.

Tex-Tube manufactures the new pipe in sizes from 1½ to 4½ inches. Present test pressures are 1200 psi for pipe from 1½ through 3½ inches and 800 psi for larger pipe. Research is expected to increase future joint test pressures to the strength of the pipe.

First the plain-pipe end is coated with epoxy adhesive.

Next the inside of the bell-shaped end is coated with epoxy.



The hydraulic crimping tool is then placed around the joint.

Crimping holds joint firmly while epoxy sets. Pipe can be laid immediately.

Special interest to those engaged in water-flooding and re-pressurizing operations:

The costly and time-consuming line pipe maintenance problems connected with flooding and re-pressurizing can now be substantially reduced with Tex-Tube Epoxy-Joined pipe. Ask your Tex-Tube representative about this special use of epoxy-joined pipe, or write Tex-Tube, Inc., 1503 North Post Oak Road, Houston, Texas.

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the Journal said...

50 years ago

January 12, 1911

Drilling activity climbs to new record level in booming Caddo field north of Shreveport in northwestern Louisiana where 75 rotary rigs are working. Ten additional rigs already are being set up and others are being moved in. Standard Oil Co. leads with 25 active operations. Gulf Refining Co. is second with 16, and Producers Oil Co. (Texaco) third with 10. This is the greatest amount of drilling in any one field in the country.

Already crippled by the long-protracted drouth with its resulting acute water shortage, oil-field work in Oklahoma is paralyzed by a severe wintry blast with below-zero temperatures. Drilling in most areas comes to a standstill. Pumping wells and pipeline pump stations hurt.

25 years ago

January 9, 1936

Record-sized gas wells for their respective states are completed in both Michigan and New York. Michigan's biggest well, Taggart Brothers, Inc., 21 Fee, in Mecosta County, flows 50 M.M.c.f. daily. New York's record-breaker, Belmont Quadrangle Development Co.'s 1 Reagan, in Allegany County, made 30 M.M.c.f. daily from Oriskany sand at 4,523 ft.

Union Oil Co. runs and cements world's longest string of casing in deep exploratory well in Kettleman North Dome field, California. Record string totals 10,813 ft. of 6⅝-in. pipe. New deep horizon to be tested. World's heaviest string of pipe (9,081 ft. of 36-lb. 8⅝-in.) previously run.

10 years ago

January 11, 1951

Six-day celebration at Beaumont, Tex., commemorates the fiftieth anniversary of Spindletop field. Oil leaders from all parts of the country throng site of Lucas gusher in field at edge of town.

Newly formed Sinclair Pipe Line Co. takes over all Sinclair pipeline facilities and operations with R. J. Tibbetts as president. Consolidation includes all existing crude-oil and product lines of Sinclair Refining Co., and working interests and ownerships in systems of Texas-New Mexico Pipe Line Co., Basin Pipe Line System, Great Lakes Pipe Line Co., and Platte Pipe Line Co.

Proved gas reserves totaling 95,000 acres in the Oklahoma Panhandle and 20,000 acres in adjoining areas of Kansas change hands in $36,000,000 purchase by newly formed Hugoton Plains Gas & Oil Co.

JOURNALLY SPEAKING

Playback on '60

IT IS OUR annual custom (if we can get around to it) to present this department's review of the year in the first issue in January.

Last week it got crowded out by the earth-shattering news that the Journal is no longer being bound with wire staples—which all readers will agree is far more important than a rehash of 1960's dismal diary.

But our review is always so cogent with insight and hindsight, so packed with significant trivia, that we figured our interpretive analysis is better late than never.

Looking back, we can't bring ourselves to say that the oil business was in a depression in 1960, or even a recession. We can't even mouth such currently popular designations as contraction or adjustment. Let's just say it was the smallest boom in years.

It was the year that management managed to manage. It was about time, too. Things had been getting out of hand. So instead of sitting around wondering whither are we trending, the top brass got on top of things. Shaky companies got shook up, but good. It was surprising some of the things that got shaken out. Some people who got reorganized down and/or out are still wondering what happened to the good old days of oil.

Dieting Americans watched their figures in 1960, and oil men watched their figures, too. They watched the figures on runs and stocks go up and the figures on prices and profits go down. Then they went on a diet—and how. Metrecal addicts are really feasting compared with oil's austerity diet.

Economy-sized compact cars overran the highways but shunned filling stations. But oil fields got less compact. Producers decided that instead of crowding their wells closetogetherlikethis they should space them far apart like this. So far the wide-spacing movement hasn't spread to filling stations.

Marketers were accepted into the petroleum family after a century of being considered black-sheep relatives on the wife's side. After a few marketing men were made presidents of big oil companies there was even talk that marketers might be allowed to call themselves oil men.

Product prices got a lot of attention during the year, too. Many companies reached the radical conclusion that they can't make money selling at a loss. A few of them even stopped doing so.

Calendar reform got much discussion. Texas producers didn't care much for the 1960 version: "Thirty days hath September but Texas hath only eight."

After a titanic antitrust suit against all major oil companies, a Tulsa court decreed that it is not illegal to raise crude-oil prices. This was a tremendous victory. Crude prices haven't advanced a penny since.

The Federal Power Commission concluded that its method of regulating gas prices was chaotic so it invented a new brand of chaos. After 6 years of thinking up arguments why cost-of-service regulation won't work, oil lawyers are now sitting up nights doping out arguments why area pricing won't work either.

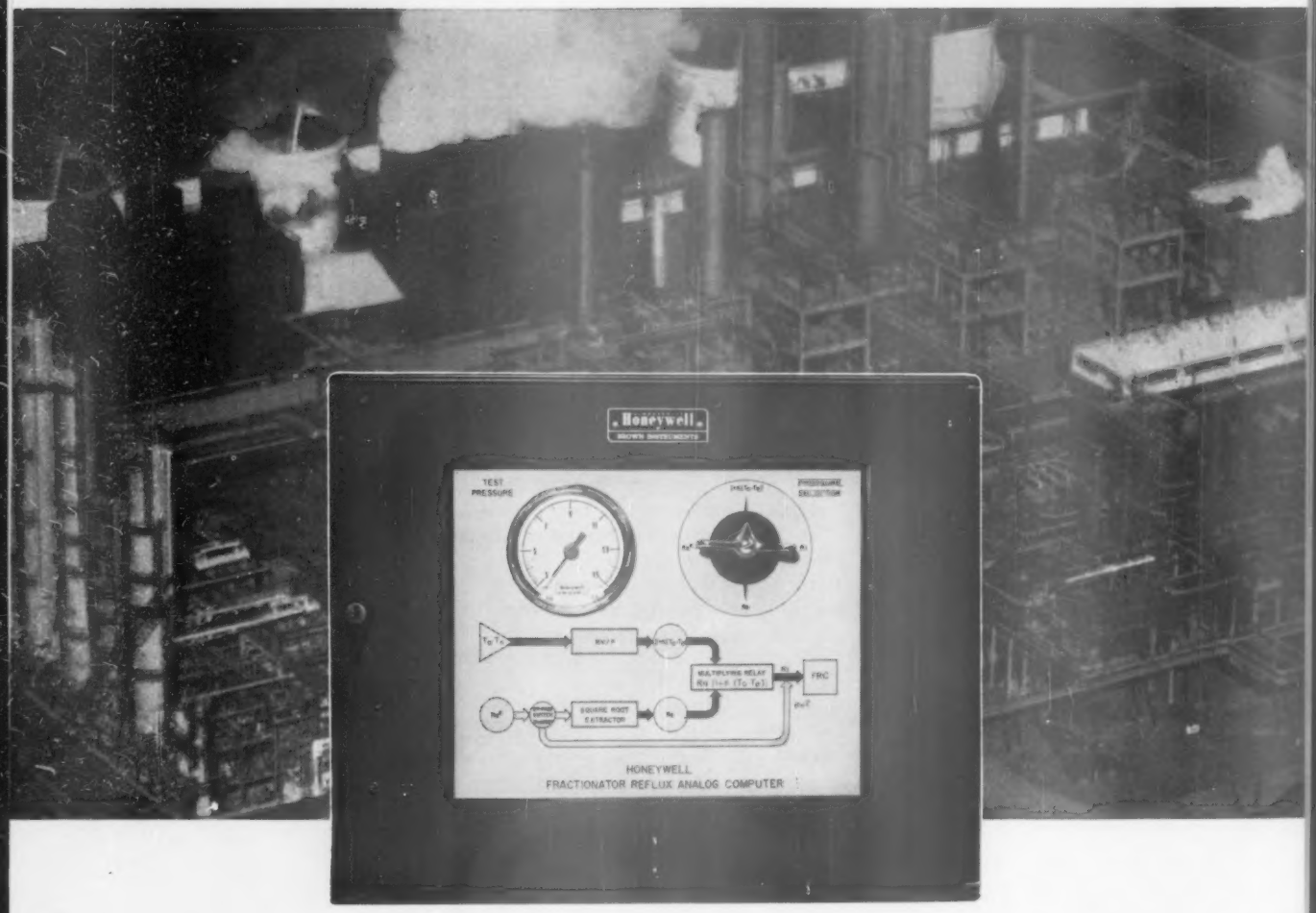
Arab oil nations held a congress which revealed that they take a dim view of: producing companies; marketing companies; tanker operators; consuming countries; price cutters; Russia; Israel; each other.

American oil men toured Russia and learned very little. Russian oil men toured the U. S. and learned very little they hadn't already read in The Oil and Gas Journal. Khrushchev raised Cain at the United Nations and pounded the desk with his shoe, while his oil exports raised Cain in world markets and pounded on prices with a shoehorn.

And the United States elected a bright young President pledged to bring a New Frontier. Maybe everything will be different in 1961.

—Henry D. Ralph

Stabilize Fractionating with new Honeywell



HONEYWELL *FRAC* CONTROLLER IS EASY TO USE AND MAINTAIN

- Standard Honeywell components, packaged in a standard Honeywell strip chart recorder case—completely wired and internally piped.
- Only four simple, easily accessible process connections required to put the unit in operation.
- Chassis pulls out for front-of-case servicing, simplifying adjustment and maintenance for your instrument technicians.

COMPONENTS

MV/P (millivolt-to-pressure) Transmitter

- Fully transistorized
- Continuously sensitive to temperature change
- Constant voltage supply
- Simple span and zero adjustments

Pressure selector and test pressure gage

- Provide check of all pneumatic pressures within the computer for simplified trouble shooting.

By-pass switch

- Permits switching from *FRAC* control to conventional external reflux flow control.

Column Operation

*FRAC** Controller

- **Easily installed and maintained by present instrument technicians**
- **Savings realized justify installation**
- **Tamper-proof design**

This new Honeywell control system immediately adjusts column operation to the effects of ambient temperature on overhead product condenser and external reflux. It continuously computes internal reflux flow, to maintain the most efficient, economical fractionating tower operation.

The new method, originally developed and licensed by Phillips Petroleum Company, utilizes a simple Honeywell analog computer employing standard Honeywell electric and pneumatic instrument components.

By correcting instantly for temperature deviation, the new control system offers the following economies.

- Less reboiler heat is required, because large surges of internal reflux that would lower temperature are eliminated.
- Reduction in off-specification product minimizes re-runs and the need for intermediate storage.
- Closer control permits fractionator to operate closer to the flooding point.

Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

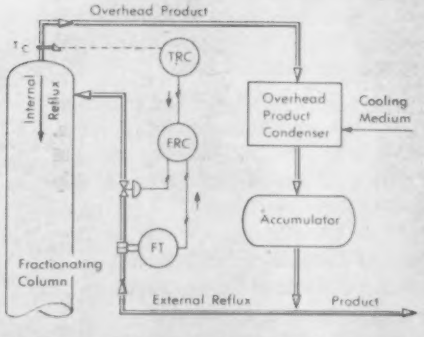
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

**Fractionator Reflux Analog Computer. Trademark, Minneapolis-Honeywell Reg. Co.*

Honeywell

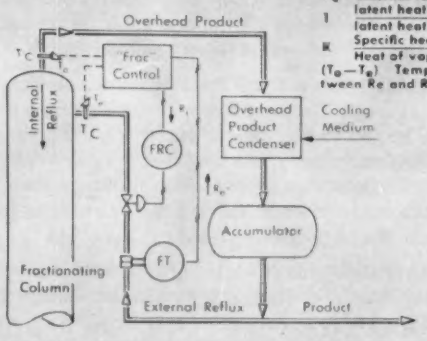
First in Control

SINCE 1885

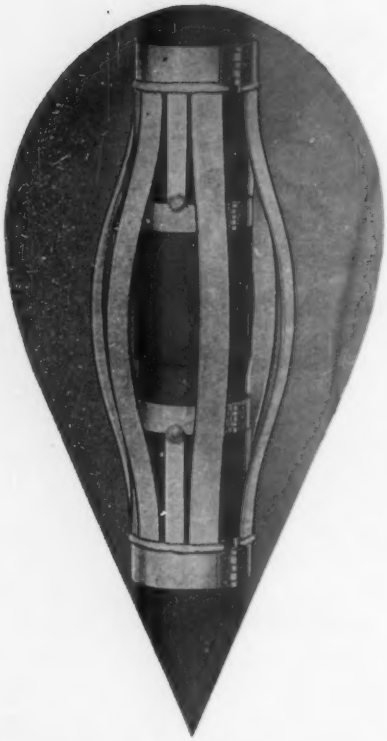


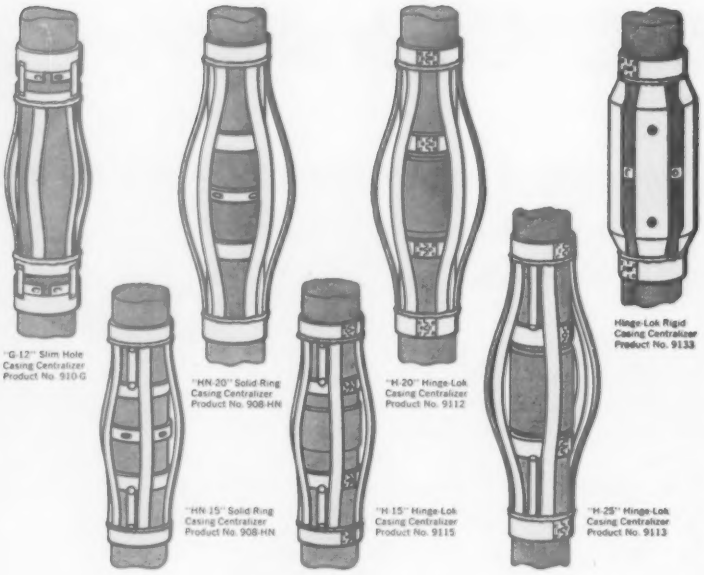
PROBLEM with existing fractionator control systems—Column is upset when temperature of external reflux is indirectly affected by changes in atmospheric conditions or in the temperature of the cooling medium to the condenser. Result: off-spec product, wasted reboiler heat, lower fractionator capacity.

R_i R_e (1 + K (T_o — T_e)
R_i Internal reflux
R_e External reflux
1 latent heat of vaporization of R_e / latent heat of vaporization of R_i
K Specific heat of R_e / Heat of vaporization of R_i
(T_o—T_e) Temperature difference between Re and R_i

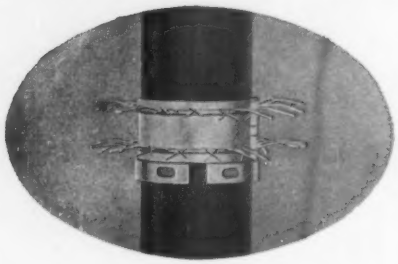


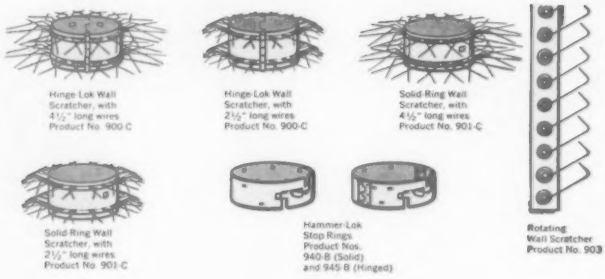
SOLUTION: *FRAC* Controller (1) measures external reflux flow rate (R_e) and the temperature difference between the overhead product (T_o) and the external reflux (T_e); (2) computes internal reflux flow rate (R_i); and (3) holds it constant by adjusting external reflux flow rate for efficient fractionator operation.




"G-12" Slim Hole Casing Centralizer Product No. 910-G
"HN-20" Solid-Ring Casing Centralizer Product No. 908-HN
"H-20" Hinge-Lok Casing Centralizer Product No. 9112
Hinge-Lok Rigid Casing Centralizer Product No. 9133
"HN-15" Solid-Ring Casing Centralizer Product No. 908-HN
"H-15" Hinge-Lok Casing Centralizer Product No. 9115
"H-25" Hinge-Lok Casing Centralizer Product No. 9113

A good cement job starts with two things




Hinge-Lok Wall Scratcher, with 4½" long wires Product No. 900-C
Hinge-Lok Wall Scratcher, with 2½" long wires Product No. 900-C
Solid-Ring Wall Scratcher, with 4½" long wires Product No. 901-C
Solid-Ring Wall Scratcher, with 2½" long wires Product No. 901-C
Hammer-Lok Stop Rings Product Nos. 940-B (Solid) and 945-B (Hinged)
Rotating Wall Scratcher Product No. 903

A good primary cementing job starts with centered casing and a good bonding surface. The only centralizers and scratchers good enough for this important job are the best ones you can get. That's where Baker comes in...

BAKER CENTRALIZERS are tough and resilient to withstand running-in forces. They are made in a wide range of spring-bow heights to provide one exactly right for your specific casing program. That's why when you're landed your casing has adequate clearance for good cementing. For installation convenience, Baker Centralizers come in both Hinge-Lok and Solid-Ring types.

BAKER SCRATCHERS glide down the hole without disturbing the mud cake; and when activated in the cementing area they dig in and remove the mud cake ensuring a good bonding surface. Baker Reciprocating Scratchers come with either long or short wires, in Hinge-Lok or Solid-Ring types. Baker Rotating Scratchers come in five-foot sections, and feature "plow angle" scratcher wires that are effective regardless of annular clearances.

NO WELD INSTALLATIONS of centralizers and scratchers are easier and better with Baker Hammer-Lok Stop Rings. Just a hammer blow locks one on. And they stay put because inserted teeth give them a much stronger grip than other friction-type stop rings.

Baker Primary Cementing Equipment is conveniently available at Supply Stores in the United States and Canada.

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CENTRALIZERS • SCRATCHERS

BAKER OIL TOOLS, INC.
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There could be net good in the Landis FPC plan

A COMPLETE SHAKEUP of the Federal Power Commission and perhaps a revision of the Natural Gas Act are possible early in the Kennedy administration.

James M. Landis has been given a White House post to start moving on his sweeping plan to regulate the regulators by clarifying policies, speeding decisions, and promoting efficiency in FPC and all other federal regulatory agencies.

For the gas industry there is both hope and danger in the plan. But the net result could very well be on the plus side.

AGREEMENT should meet these Landis observations:

- Amendment of the Natural Gas Act is essential.
- There is inordinate delay in making decisions.
- Cost of an FPC case is excessive.
- Procedures are too complicated and complex.
- Regulation should be flexible and analogous to business judgment rather than adherence to a formula designed for a different set of facts.
- FPC has no plan or policy, nor is a pattern discernible in its case-by-case decisions.
- The staff has captured the commission, its personnel is of mediocre quality, and independent thinking is lacking.
- FPC has not used the authority it has to keep abreast of its docket, such as exempting inconsequential cases from full-blown investigations.

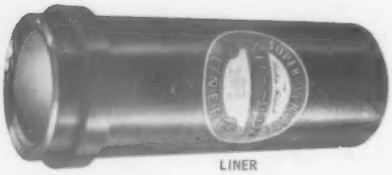
Along with measures applying to all agencies, Landis proposes specifically for FPC a strong chairman with responsibility for improving internal procedures, seven commissioners with 10-year tenure, and authority to delegate run-of-mine decisions to panels or subordinate officials.

A presidential Office for the Coordination and Development of Energy Policy is part of the Landis plan. It is here that first consideration may be given to a new natural-gas law. Conceivably this could work out better than having Congress start cold on fuels policy and gas legislation.

On the other hand, there are sinister aspects to Landis' implication that FPC has a mandate to prevent any price increases, and in his charges that FPC is contemptuous of the law and the courts, lacks "consumer interest," and is "industry oriented."

CONGRESS MUST PASS ON most of the forthcoming changes and this will give a chance for industry views to be heard. Also it is presumed that the Landis office will consider industry representations before submitting specific legislative proposals.

So here's a sudden opportunity for all segments of the gas business to state their views on fuels policy, gas controls, and regulatory procedures—an unexpected break in the Washington stalemate that has a potential for pointing a way out of the gas-price mess.

The Mission  Mission

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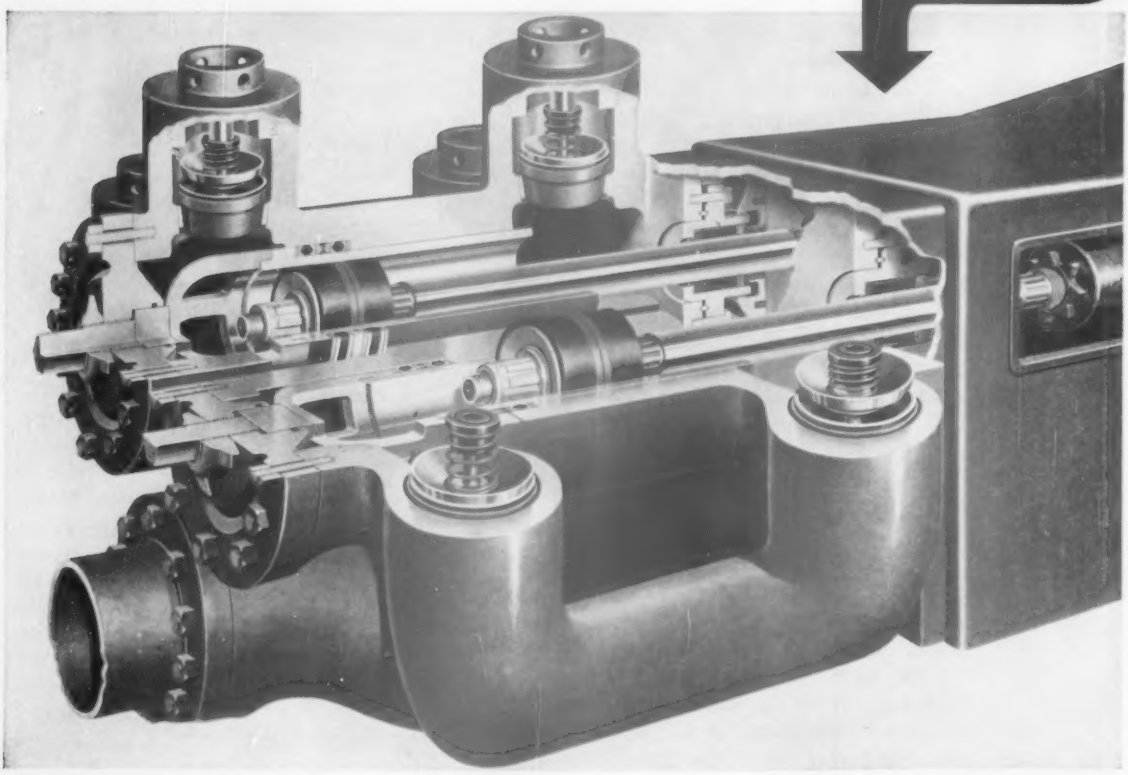
are all designed and made in our modern to work together to cut your drilling costs.

PLANT



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Independents Rival Majors In Cost Cutting

- Anything that costs money is checked to see if the same thing can be done as well for less.
- Most rewarding efforts for smaller firms have been in the area of drilling and production.

Robert J. Enright
District Editor

LAST AUGUST, Delhi-Taylor Oil Corp. of Dallas formed a new department with a fancy name—"production technical services."

The job it is doing, however, is very down-to-earth. The department is responsible for "increasing the effectiveness and decreasing the cost of drilling and production operations so that the greatest ultimate gain may be derived from each dollar spent."

In brief, Delhi seeks to produce oil cheaper.

The importance attached to this job by Delhi management is emphasized by selection of its general production superintendent, Henry Kerr, to head up the new department. Kerr has been relieved of all other responsibilities.

Though Delhi has perhaps gone further in this direction than most, a Journal survey shows most smaller operators are hacking away at costs just as energetically as the majors whose efforts have been better publicized.

And smaller firms are scrutinizing everything that costs money—whether it involves drilling, payroll, paperwork procedures, selection of equipment, secondary recovery, or what-have-you.

1. In Drilling

No matter how you slice it, it still costs a heap of money to drill a well. And many operators, even with the contractors' current bargain footage rates, feel drilling is a fertile field for cost cutting.

Some are working hard toward this end—and getting results.

"Fixed fee" contract . . . British-American Oil Producing Co., for instance, has cut its drilling costs up to 10% through use of a new twist in drilling contracts which it calls a "fixed fee" or "fixed cost basis" type of contract.

During the 18 months, BA has used the fixed-fee contract on 55% of its wells in estabished drilling areas.

The "fixed fee" variation resembles a turnkey operation but there are some important differences. It sets out a flat footage rate. In this price per foot, however, the contractor is asked to include his cost of furnishing everything (including drilling mud, logging, location, site cleanup, payment of damages to farmer) except for certain specified services.

These exceptions, for which BA pays the contractor a fixed fee, include: Drill-stem tests, cutting cores, running oil string, pulling casing, plugging wells, and any shutdown time requested by the company. There is no day work.

How does this save money? Wesley Moore, drilling analyst for BA says it eliminates much duplication of effort by contractor and operator personnel. The contractor is free to put down the well in whatever way he wishes, using any materials or techniques he desires. And BA needs no drilling foreman on the project.

At the same time, Moore says, the contractor has a powerful incentive to drill the well as cheaply as he can.

The contractor, too, arranges for services by third parties. And it is a quirk of the business that he can generally get a better price than an operator.

"We're not trying to save money at the expense of the contractor," Moore says, "but by hiking overall efficiency. We know we've saved money and the contractor made some. The contractors appear to like it."

All day work . . . Delhi-Taylor is going in the opposite direction to achieve the same ends in its Dakota drilling program in the San Juan basin.

By doing all drilling on day work—in essence, taking over the rig—Delhi thinks it can cut the drilling cost of the average hole in its multiwell Dakota program by about $30,000.

The Dakota wells have cost Delhi $130,000 to $140,000 apiece. Kerr thinks the day work innovation will cut the average per-well cost to about $90,000.

Savings will stem primarily from reduction of previously heavy drilling fluid losses and full application of the bit weight-rotary speed tables developed by Hughes Tool Co. engineers.

Delhi engineers, with Hughes'

help, are gathering carefully measured data on bit wear in the area. With this data, company engineers feel they can milk these tables to the maximum with highly rewarding returns in penetration and bit performance. But, since such application is complicated, they feel they must have complete control of the drilling operation to carry it off.

The same is true of Delhi's planned attack on heavy mud losses. The company thinks it can cut these costs in several ways, but principally by using lower circulating rates.

Normal practice in Dakota wells is to use jet bits with fluid velocity of about 140 ft. per minute. Close study of the situation has convinced Delhi it can reduce this velocity to about 120 ft. per minute and cut lost returns substantially with little or no sacrifice in penetration rate. Other planned measures, such as going into and coming out of the hole at lower speeds, should help too, Kerr thinks.

5,500 ft. for $11,000 . . . An East Texas operator found it highly profitable to go the same route—that is, drilling entirely on day work.

This company was dissatisfied with the cost of 5,500-ft. wells and was unable to convince the contractor that he should be able to do it much cheaper. It took over the rig, paying the contractor on a flat rental basis.

The company made some minor equipment changes, and began completing the wells for about $11,000 each—far under the previous cost.

Operators using the all-day-work route successfully, however, caution that it is not a sure-fire, blanket technique than can be applied anywhere. You have to pick your spots.

The company using it to such advantage in East Texas normally is inclined to go almost in the opposite direction toward the turnkey-type operation.

Multiple-well deals . . . British-American feels it has saved 7 or 8%, perhaps as high as 10%, in footage costs in several instances by outlining a development program in a field where it has several wells to drill.

It has recently completed two 8-well programs—one in southwestern Nebraska, one on the Gulf Coast—with gratifying results.

When drilling, geological, and production departments agree on such a program it is handled as a package rather than on a well-by-well basis. Field men can carry out this program as quickly or slowly, within reason, as they see fit. And just one contractor does the drilling.

The company, Moore says, gets a substantially lower footage price since the contractor is looking at several wells and doesn't have to net back heavy moving costs, extra labor and other charges.

Letting it drift . . . Slim-holing is mentioned by many smaller operators as a technique they are applying to cut costs.

In crooked-hole country where beds dip steeply, more are adopting the BA-pioneered method of speeding drilling by calculating the direction and amount of drift, moving the surface location to compensate, then putting heavy weight on the bit and boring full-speed.

More operators are liberalizing rate-of-deviation clauses in their drilling contracts in hard-rock country where beds dip, a production manager says, "because you can't drill a straight hole there and do it cheap."

In awarding contracts, too, he says, more operators are trying hard to get a contractor with the proper size rig for the projected well. They also are checking to see how far the contractor will have to move his rig to get it to the location.

Cooperation rewarded . . . A Texas company whacked $1 a foot off its drilling costs in one development program following a series of conferences by its geological, engineering, and operating personnel with the contractor.

Drilling time per well was cut from 28 to 23 days. Much of the saving was the result of using idle contractor personnel to prepare locations. They equipped the location with water and gas lines, dug the cellars and pits so the rig was moved directly onto a new location after finishing a well.

Contractor-operator coordination of efforts was continued through the drilling operation "resulting in considerable savings both to the company and the contractor."

Casing costs eyed . . . Aside from scrimping on hole making, smaller operators are also cutting as many corners as possible on the costs of major materials used in drilling.

Republic Natural Gas Co. estimates it has saved, through use of one technique, 15% on surface casing during the past year.

When drilling an edge well that might be dry, Republic may set only 500 ft. of casing where rules normally require 2,000 ft.

If the well should make a pro-

Delhi-Taylor Has a Full-Time Cost Cutter

A GOOD EXAMPLE of the vigorous efforts by smaller companies to lower their unit costs of producing oil and gas is the appointment of Henry Kerr to head the new production technical services department of Delhi-Taylor Oil Corp. The work of Kerr and his associates is aimed exclusively at getting more for the company's dollar in the field of drilling and production. A motto for executives of Kerr's type could well be stated in the phrase, "Get Mileage from Dollars."

ducer, Republic runs a differential-valve tool and circulates cement from the bottom up to base of the surface string at 500 ft.

Cement is cheaper than steel. And Republic also saves the extra money that would have been spent in drilling 1,500 ft. of larger hole.

This procedure, of course, requires the cooperation of regulatory bodies in some states in granting exceptions to field rules. But Republic has had little trouble getting such permits, since its procedure still protects fresh-water sources.

Haggling on services . . . Service companies specializing in perforating, acidizing, fracturing, etc., are finding that their posted prices are not accepted by many operators as the last word.

Lots of operators are asking service firms to bid on multi-well jobs or even on single wells where the job is large and expensive. A few now are carrying bid asking even further to apply it to equipment items, such as well heads.

2. Production

Smaller firms are working strenuously, too, to cut the cost of producing oil.

Their efforts fall largely into two areas — administrative and operational.

Cost-shaving in the administrative area is mainly directed at producing the same amount of oil with fewer but better-trained employes.

Personnel pared . . . A large independent in the Southwest, its general production manager says, has saved $150,000 a year by a 20% reduction in its field operating force.

It did this by combining some offices, shuffling personnel, doing away with some clerking jobs, giving early retirement in some cases, using contract pumpers and well-servicing in some spots, and "stretching some men out a little further."

This was done without impairing company activity or reducing its production.

The reduction in clerical personnel followed a "systems and procedures" study which eliminated many non-essential reports and simplified other reports and procedures.

The same company has eliminated 24-hour gaging services. And it is making quarterly surveys of the work loads of the labor crews it still maintains on its payroll.

Blackwell Oil & Gas Co., Tulsa, has turned to contract labor for all its drilling, workover, pumping and roustabouting.

Delmar Cox, chief engineer, says the company sacrifices something in efficiency but that savings in payroll. insurance, and transportation more than make up for it.

To counter the efficiency loss, Blackwell places great stress on excellent supervisors.

The fruit of this two-pronged policy is low overhead. A good example is a water flood comprising 220 wells which Blackwell operates with just two foremen and contract labor. This permits Blackwell, Cox says, to operate the project for about half what it would cost a major company.

The chief engineer of a Dallas-based company says its engineering manpower has been cut to a bare minimum. "We no longer carry the manpower reserve we used to feel was necessary to hedge against sudden resignations or booms in our area of operations," he says.

Training emphasized . . . While aiming at getting the job done with fewer employes, many smaller companies are also upgrading personnel by training programs.

Delhi-Taylor already has held schools for its drilling employes in the latest advances in mud and bit technology. Mud and bit firms worked with the company to set up the courses and furnish instructors.

And late last month a group of Delhi production employes were studying modern completion techniques in a special program worked out in cooperation with another service firm.

Other operators are sponsoring their employes in training programs offered by the American Petroleum Institute, the American Association of Oilwell Drilling Contractors, and by college and university extension services.

Tailoring equipment . . . Independent firms, large and small, are engineering equipment installations as never before.

A substantial operator in Louisiana and Arkansas made great savings in pumping costs by revamping many of its wells. Frequent sucker-rod failures were eliminated by running strings of proper strength. Overloaded pumping units were removed and replaced with reconditioned surplus units from other areas. Inefficient gas-lift systems were replaced with hydraulic units.

The results in increased production and lower maintenance were eye-opening.

Another firm found it could cut its operating costs considerably on some gas-lift systems by installing compressors and closing the systems.

The same company reports solid savings have stemmed from standardizing its tank-battery designs so that units are interchangeable and can be easily switched to make batteries larger or smaller.

More wells are being dualed, tripled, and quadrupled—both producers and inputs— and more multizone pumps used.

An Oklahoma independent is purchasing portable pump units that can be shifted easily from job to job.

Thin-wall pipe is drawing more attention from smaller operators— especially for low-pressure use.

A Dallas company has found that it can pump two wells into one lead line without trouble.

Another medium-sized firm is prolonging the useful life of fatigued sucker rods in wells in heavy-duty pumping areas by pulling them and rerunning them in shallow, light-pumping wells.

Healthy development . . . Many smaller companies now are even devoting attention to initiating corrosion-control programs to cut maintenance and replacement costs on pipelines, well casing and tubing. This is a field they largely had ignored in the past.

This intense preoccupation with cost-cutting and efficiency is a good sign, one production manager thinks. It is rapidly improving profits for majors and smaller firms alike.

It is proof, he feels, that the industry can live with ultra-low allowables and still make money. And oil surpluses, he points out, have a habit of working themselves off.

Streamlined Socony Takes Bigger Steps

• Revamped company tots up higher earnings in first three quarters of 1960 but it's too early to evaluate the full effects of reorganizing. Officials are sure the new team effort will keep pushing profits up and costs down.

Gene T. Kinney
East Coast Editor

IN ITS FIRST YEAR of operation, the "new" Socony Mobil Oil Co., Inc., is beginning to reap some of the benefits it sought through a world-wide reorganization.

For the first 9 months of 1960, earnings were up 10½%—double the industry average. In marketing, where the over-all reorganization started in 1958, volume per outlet is up 15% over 3 years ago.

However, it would be a mistake to attribute these results to corporate reorganization without examining prices and other business conditions.

Although streamlining can bring economies by cutting out duplicate functions, centralizing purchasing and accounting, and reducing personnel, the balance sheet does not yet show the real fruits of the reorganization.

Its significance at present is most evident in the enthusiasm of personnel. They have full confidence in the new corporate alignment. Nearly all feel that the company is operating "smarter," that it has established clearer aims based on sounder planning assumptions, and that it now possesses a system of review which will help meet its goals.

The old and new . . . Under the old system, a federation of affiliates—Magnolia Petroleum Co., Mobil Producing Co., and General Petroleum Corp.—handled jobs in various domestic areas.

Each had its own objectives. The organization structure made it difficult to assure that the efforts of one were helping the others to contribute to the maximum profits from all operations.

The new organization is vastly different. Now Socony has a "single-profit team." This supplies the profit-making potential of many units working together. Before, the potential depended on uncoordinated efforts.

Under the parent Socony Mobil, the new Mobil Oil Co. consolidates all U. S. and Canadian oil and gas operations. Mobil Chemical Co. handles world-wide chemical activities. Mobil International Co. functions in 80 countries—all the foreign areas outside the territory of the old Standard-Vacuum Oil Co.

Completing the subsidiaries is Mobil Petroleum Co., latest addition to the team, which was created to take over Stanvac properties after the planned division by Socony and Standard Oil Co. (N. J.) (OGJ, Nov. 21, 1960, p. 143).

In the phrase of Albert L. Nickerson, president of Socony, the parent-company management operates on a basic philosophy of "centralized policy-making and decentralized administration."

This arrangement breaks down horizontal and vertical barriers to communications. Management is in the driver's seat with finger-tip control over a more responsive business vehicle.

One phase of the current thrust for more profits involves taking advantage of benefits inherent in the new company structure. Another phase deals with capital conservation—cost cutting, improved investments, better use of existing facilities, and new profit sources.

What victories are being won on these fronts?

More than a few, Socony told the Journal.

Planning, analysis, economics . . . One of the key units in the single-profit team is the planning, analysis, and economic department. This was created last July by merging two other departments.

The new unit is charged with a vital role in company operations. Its planning and analysis segment has these tough responsibilities:

. . . **Recommending** to operating and corporate management long-range integrated business plans for growth and operation.

. . . **Formulating** the distribution of capital funds among geographic and functional areas of the corporation.

. . . **Developing** criteria and techniques to assist headquarters and field management in making investment decisions.

. . . **Evaluating** and recommending courses for specific investment projects that either involve unusually large sums, are interdivisional in nature, or require close coordination of several functions such as manufacturing, marketing, exploration and producing, and transportation.

Should the company enter a new exploration play? Should it pull out of a problem market or intensify efforts there? What arrangement of refining facilities seems to fit best with the company's business plan for 5 or 10 years hence?

Answers for questions like these are also sought by the planning and analysis group.

A second arm of the new department, the economics and special studies group, has the responsibility for:

. . . **Analyzing** and forecasting economic conditions and petroleum-industry supply and demand.

. . . **Preparing** assumptions to be used as bases for planning.

. . . **Reporting** periodically on petroleum data.

. . . **Detecting** trends and consumer preferences.

. . . **Evaluating** Socony's financial performance to determine strengths and weaknesses in comparison with the showings of competitors.

. . . **Reporting** financial comparisons quarterly to the board.

. . . **Forecasting** petroleum prices and recommending pricing policies and objectives to the planning and analysis group.

. . . **Seeking out** and evaluating

Toward Goals

any special investment opportunities.

"The formation of the planning, analysis, and economics department provides the corporation with a business service which gives a clearer picture of environmental conditions as they relate to the long-range objectives.

"It is important for this department to have a good feel for supply-demand factors, to be able to spot trends, and to communicate them throughout the corporation in time to make adjustments in long-range business plans."

Management information . . . The new management information service also is important to the drive for company improvement.

This service is a control or measure of performance, keyed toward management responsibility. An operating plan for each company unit (refineries, divisions, and the like) is projected for the year. Every month a unit can match its sales performance against the projection. Local managers are made more profit conscious.

Manpower development . . . Manpower for key jobs is another critical factor in progress.

Socony wants to assure a supply of talent and to open up promotion opportunities at the same time.

Reorganization has erased some rather rigid division lines that formerly isolated personnel.

Even before the structural changes, a managerial development and inventory program was begun in marketing. A 1957 task group interviewed supervisory personnel in what were then Socony Mobil's 10 marketing divisions.

Executive evaluation and performance records were inaugurated.

This program is being placed in effect throughout the company. Socony says the project is still in its infancy.

But, company officials add, "the walls between various parts of Socony Mobil are coming down. The objective is to assure that functional and geographic boundaries do not stand in the way of recruiting, training, and advancement.

Reorganization progress, results . . . Other steps have been taken to capitalize on the reorganization.

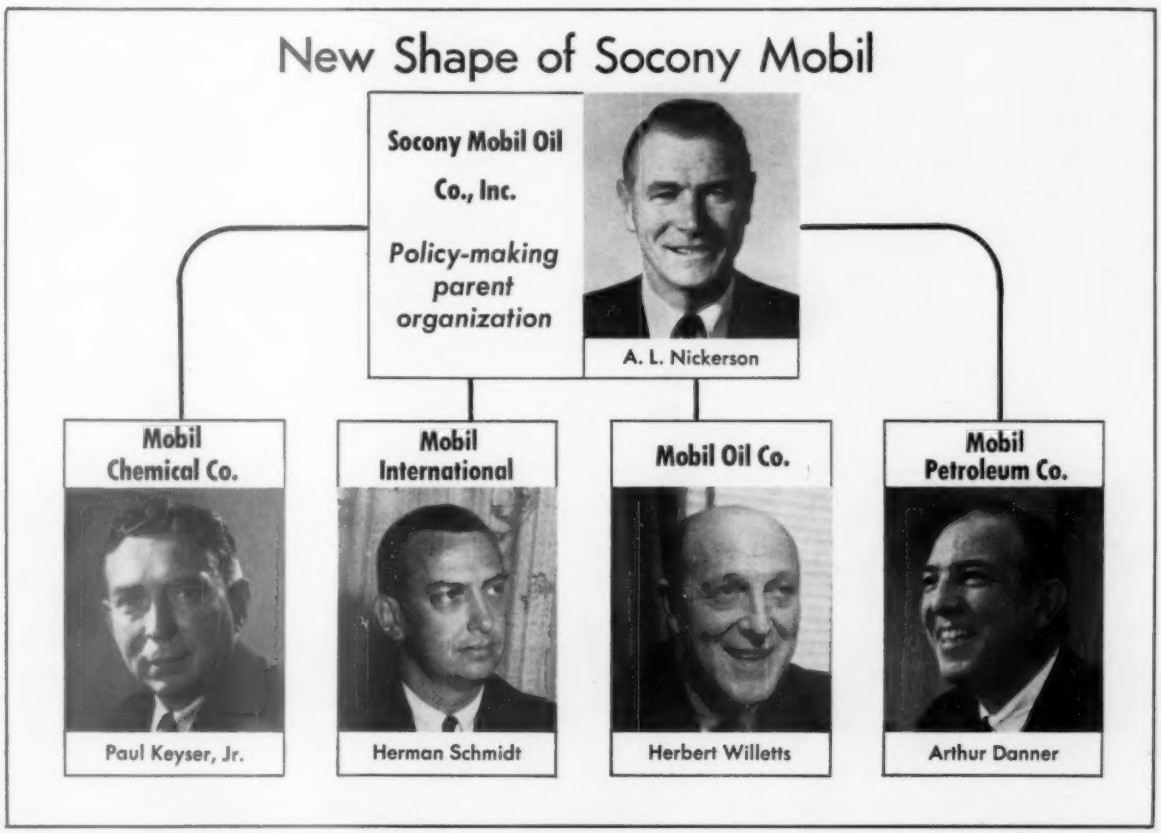
Where previously there were three functional departments engaged in the same activity, there is now one per activity in the U. S.

Several divisions were combined, and costs fell. Four exploration and producing divisions were set up. Forty-six district offices were reduced to 16.

With the marketing department being "Mobil" from coast to coast, advertising outlays slimmed.

More savings came from centralizing the general administrative functions for pipelines at one headquarters. The Central Pipe Lines division and the Eastern division were merged into Magnolia Pipe Line Co., Dallas.

Reorganization of the supply and distribution department packaged responsibilities for crude and prod-



MOBIL Company presidents, bottom row, also are executive vice presidents of Socony, reporting to president Nickerson.

uct supply and for distribution planning.

Electronic computers give refinery managers better internal control over processing, and will show the best method of moving product to market.

New accounting and service centers are relieving field offices of much paper work.

Central coordination plus regional buying is expected to bring sizable savings.

A new credit office within Mobil Oil plans credit policy and activity, permitting faster work than was possible when this function was centered in the corporate treasurer's office.

Capital conservation . . . Gains are being made in capital conservation, too.

Cost-cutting ideas generated at a world-wide conference of drilling personnel are being followed up.

The trend is away from rigs owned and operated by the company. Now, preferably, the company owns the rig and a contractor operates it—or the contractor is both owner and operator.

More automation is being installed, particularly on leases.

Coking units are being used to upgrade low-value material.

Aiming at new profits, Mobil Chemical Co. is putting up a high-purity ethylene plant at Beaumont. A benzene plant also is being built.

And the service station is getting a once-over in the campaign. Station sites are being selected more carefully with a view toward requiring a higher return than before.

Rig Drills 90-in. Hole

OIL-WELL techniques are being used to sink a uranium shaft in the Ambrosia Lake area northwest of Grants, N. M.

Kermac Nuclear Fuels, Inc., is using a rotary rig to drill a shaft 90 in. in diameter.

According to the company, this will be the largest shaft ever drilled by a rotary rig. Some 44-in. ventilation shafts have been drilled previously in the Ambrosia Lake uranium-mining area.

Kermac is making plans to sink a shaft 10 ft. in diameter at another location with a similar rig.

For California: Big New Flow of Gas

PROJECTS now in the works would increase California's imports of natural gas by more than 70% and raise the total to almost 4 billion cubic feet per day.

El Paso Natural Gas Co., pioneer supplier of the California market, completed the first gas line to the West Coast in 1947. In the next 13 years, it expanded its system eight times and now delivers more than 2 billion cubic feet per day.

El Paso and Colorado Interstate plan to add another 470 million cubic feet this year and El Paso has asked the Federal Power Commission to okay a further increase of 200 million cubic feet.

The Transwestern line, built in 1960, added 300 million feet; the Pacific Gas & Electric line from Alberta, now under construction, will add 415 million; and the proposed Tennessee Gas-Pemex project would add another 455 million.

If all projects go through, California will be able to import 3,899 million cubic feet per day—almost $1,600,000 worth of natural gas every 24 hours.

A Postwar History of California Gas-Import Projects

Company—	Date Authorized	Volume (millions cu. ft.)
El Paso Natural Gas Co.	May 1946	305
	1948	250
	Sept. 1948	100
	July 1950	150
	June 1952	300
	Dec. 1952	300
	Nov. 1955	350
	Dec. 1956	150
	Mar. 1958	150
Transwestern	Completed 1960	300
P. G. & E.	Completion due 1961	415
El Paso-Colorado Interstate	Dec. 1960	470
Tennessee Gas-Pemex (proposed)		455
El Paso Natural Gas (applied to FPC)		200
TOTAL (built, building, or proposed)		3,895

Cities Service Changes Name

. . . of its exploration and production company. This is another step in its corporate alignment plan.

AS A FURTHER move in consolidating operations of Cities Service Co., the corporate name of Cities Service Oil Co. (Del.), headquartered in Bartlesville, Okla., has been changed to Cities Service Petroleum Co.

The top officers will remain the same—Robert L. Kidd, chairman of the board and chief executive officer, and J. E. Heston, president.

They were named in November when Cities Service pulled together all domestic-oil exploration, production, and related activities into the Delaware company (OGJ, Nov. 14, p. 110). Canada is also included.

This was the first step in a corporate realignment announced in anticipation of exemption from the Public Utility Holding Company Act. Last month, the alignment was made possible by Cities Service's acquisition of the 48.5% public minority stock interest in Arkansas Fuel Oil Corp.

Marketing consolidation . . . The next step, taken 2 weeks ago, was consolidation of the marketing activities of four subsidiaries into a single company.

The new marketing company is Cities Service Oil Co. It will take

over marketing operations which have been conducted by Cities Service Oil Co. (Del.) in 14 mid-western states, Arkansas Fuel Oil Corp. in 10 southern and southeastern states, Orange State Oil Co. in Florida, and Cities Service Oil Co. (Pa.) in 13 New England and Mid-Atlantic states (See p. 128 for personnel changes.)

The tighter marketing organization will eliminate duplication of effort and overlapping functions, and will open the way for unified strategy and promotion throughout the Cities Service sales area. Marketing activities have been more or less autonomous in the past.

Refining next . . . With producing, exploration, and marketing consolidated, refining remains the only major function which is still being carried out by separate affiliates.

Cities Service (Del.), before the recent shifts, engaged in all phases of the oil business. It owns refineries at East Chicago, Ind., and Ponca City, Okla. The Pennsylvania company owns an asphalt refinery at Linden, N. J.

Cities Service Refining Corp. owns a refinery at Lake Charles, La., Cit-Con Oil Corp., owned 65% by Cities Service, has a lube-oil plant at Lake Charles. Combined refining capacity of the companies is 313,000 bbl. daily.

Consolidation of refining, the next logical step, would strengthen the coordination of company-wide supply and distribution.

TGT, Cary Team Up

. . . to produce and market petrochemical products.

TENNESSEE Gas Transmission Co., Houston, and Cary Chemicals, Inc., East Brunswick, N. J., have teamed up to produce and market polyvinyl chloride products.

Tennessee Gas will build a plant on its Houston Ship Channel property to make acetylene and vinyl chloride monomer. Cary will expand its vinyl polymer, compounding, and calendering facilities. The companies will closely integrate their programs.

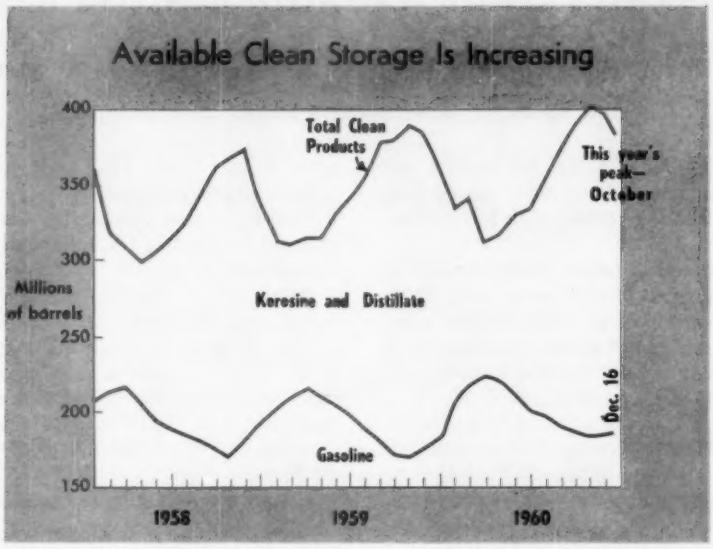
Cary will continue as an independent, publicly owned corporation in which Tennessee Gas will have a substantial interest. Cary is expected to have an equity interest in the Tennessee Gas plant, which will be started in 1961 and completed in 1962.

The Ship Channel plant will be the first development of the 794-acre site which Tennessee Gas acquired in 1959 west of Shell Oil Co.'s Houston refinery.

The new project is another step of Tennessee Gas toward broader participation in the so-called unregulated activities in the handling of hydrocarbons, company officials said.

The plant will consist of an acetylene unit with a capacity of 100 million pounds annually and a vinyl chloride monomer unit that will use a major part of the acetylene.

The monomer will be shipped to Cary. There it will be converted to vinyl polymers for compounding, calendering, and finishing, and for sale to the vinyl market. Also, Cary will intensify its vinyl research and development program.



Refiners Don't Need to Dump Gasoline

COLD weather last month may help keep gasoline prices firm next summer.

Explanation for this apparent anomoly is the chain reaction weather has on refiners' clean storage.

It works like this:

Low temperatures kick up demand for kerosine and heating oils, moving these products out of storage and into trade channels.

The vacant tankage allows refiners to store the excess gasoline they are forced to make in the motoring offseason. Refiners can then hold the material until demand for motor fuel picks up in the spring.

Without storage, they would be forced to dump gasoline into trade channels at cut-rate prices. And gasoline price cutting in the late winter usually depresses the market well into the motoring season cutting sharply into refiners' profits.

Clean storage, as the chart shows, peaked this year in October at 401,900,000 bbl. of which 185,400,000 bbl. was gasoline and 216,500,000 bbl. kerosine and distillates.

By mid-December products in clean storage totaled 384,000,000 bbl. Gasoline in storage had climbed to 190,000,000 bbl. and distillates had dropped to 194,000,000 bbl.

Under normal conditions gasoline in storage will continue to climb and distillates drop until the end of March. Then the total of products in clean storage is at the year's low, and the cycle starts again.

Texans Seek Helium Permit

• Independent firm wants to build an extraction plant and make sales to Government under new program.

HIGH PRICES for helium and favorable federal laws are proving an alluring combination to oil operators.

Late last month, Kerr-McGee Oil Industries, Inc., announced early construction of a $2,000,000 plant to extract helium from gas produced at Pinta dome, Apache County, Arizona (OGJ, Jan. 2, p. 55).

Last week, a Texas independent filed with the Interior Department for a permit to process helium from gas produced in the White Deer area of the Texas Panhandle and sell it to the Government.

New legislation permits the Government to contract for helium with private operators.

Applicant is Helium Conservation Corp., Midland, Tex., headed by M. T. Stallter as president and O. H. Berry as executive vice president. Stallter and Berry fill the same positions with Texas-New Mexico Development Co., an independent oil firm.

Helium Conservation plans to extract helium from gas produced from a 63,000-acre spread of leases in the South White Deer area of Carson County. Much of this block now is undeveloped, but a drilling program is in progress. Currently, 17,000 acres of it produces gas with helium content ranging up to 2.2% by volume, the company says.

Stallter said last week that development plans call for a gathering system and a $3,000,000 extraction plant 3 miles northeast of White Deer. Initial capacity would be 50,000,000 cu. ft. daily of helium-bearing gas. Graridge Corp. would be plant operator.

Owners of working and royalty interests in the connected wells, Stallter said, would share in the profit from helium sales.

Monterey Stockholders Approve Sale

MONTEREY OIL CO. is scheduled to go out of business this month and become a division of Humble Oil & Refining Co., the domestic operating subsidiary of Standard Oil Co. (N. J.).

Monterey's sale to Humble received formal approval of Monterey stockholders at a special meeting in Los Angeles December 22. The sale will have a closing date sometime in January. Monterey will turn over its assets to Humble for $118,300,000.

The sale is expected to net Monterey about $82 million or $42 a share. The sales price includes a $72 million production payment which Humble is expected to repay in the next 8 to 11 years (OGJ, Nov. 28, p. 44).

The big question now is what will happen to Monterey's 950,000 shares of stock in Transwestern Pipeline Co. At last report, Monterey was planning to distribute the stock along with the first liquidation payment to stockholders.

However, there is also a chance the company may sell the Transwestern stock. Selling the stock following stockholders' approval is more likely since Monterey can sell as a liquidating company and avoid a stiff tax bite.

Two other properties are excluded in the sale to Humble: Monterey's 25% interest in a 3,840-acre tract now under development off Santa Barbara County, Calif., and the company's undeveloped leases in Alaska.

Humble has an opportunity to buy the offshore property, but Monterey is negotiating with a third party which may buy the interest. Monterey holds the lease along with Texaco Inc. and Newmont Oil Co.

INDUSTRY BRIEFS . . .

Socony Mobil Oil Co., Inc., has bought all assets of Anchor Petroleum Co., Tulsa, nationwide LPG wholesale marketer. Included was all stock of Petrolane Gas Co., Inc., New Orleans, retail subsidiary of Anchor. Not involved is Anchor Production Co., an oil and gas producing company. W. A. Baden, Anchor president, will continue with Mobil in a consulting capacity.

Alberta's production rate for January is 20% higher than the December allowable. The Alberta Conservation Board will allow crude producers 427,062 bbl. daily and condensate yield will be 11,725 bbl. daily. This production will be supplemented by about 4,000 bbl. of non-prorated natural gasoline.

COG Minerals Corp. has been merged into Colorado Oil and Gas Corp., which owned more than 90% of COG's outstanding common stock.

A second 4,250-acre tract off Santa Barbara County, Calif., has been put up for leasing by the State Lands Commission. The tract is 2 miles east of Parcel 1, which will be leased in February. The new tract, Parcel 2, will be leased in March. The state has at least five tracts off Santa Barbara it plans to lease singly at 1-month intervals.

Contract for expansion of Continental Oil Co.'s research and development facilities at Ponca City, Okla., has been let to Manhattan Construction Co. The main laboratory will be doubled in size, and a service building will be erected. Cost is estimated at $2.2 million.

Merger of Welex, Inc., into the Halliburton Co. has given the former organization full status as an operating division of Halliburton. Welex was acquired by Halliburton in 1957 and operated as a subsidiary corporation until the recent merger.

New Taxes Grip Canada's Foreign Firms

• Big reason for slapping higher levies on subsidiaries of foreign corporations is the government's determination to ease the trade deficit. The stringent rules are expected to raise $50 million. Oil's hit hardest.

Gene T. Kinney
East Coast Editor

WITHOUT WARNING, Canada has thrown a noose of stricter tax laws around foreign-controlled enterprises and yanked it tight.

Increased withholding taxes suddenly imposed on Canadian subsidiaries of foreign corporations will squeeze out an extra $50 million this year from dividends due parent companies.

This and other moves sprung by the Canadian Government at year's end will have the effect of:

. . . **Reducing** the incentive of foreign capital (of which oil comprises a large percentage) to enter Canada. Hikes in taxes on dividends and in taxes on interest paid to foreign corporations will dampen any enthusiasm.

. . . **Increasing** the incentive of Canadians to invest and borrow at home. This will be achieved by cutting taxes on investment income from Canadian sources, and by raising taxes for investor groups unless they put most of their money in Canadian enterprise.

The tax changes went into effect when Donald M. Fleming, minister of finance, read the budget to the House of Commons. He also announced an important tariff revision which could raise the duty on imported oil-field equipment and supplies.

And there's more action vital to petroleum and business in general pending in the session of Parliament which convenes next week.

Legislation to be introduced by the Conservative government, supported by an unprecedented majority of 206 of the 265 seats in Commons, will include: (1) Tax incentives for encouraging more foreign corporations to open subsidiaries to Canadian ownership, (2) requirements for financial reporting by foreign-controlled corporations and labor unions, and, (3) liberalizing restrictions on insurance company investing in common stocks, thus opening Canada's biggest untapped source of capital for this purpose.

The government also must decide what, if anything, to do about proposals for a national oil policy to give domestic producers a larger share of the eastern market.

Effect of tax changes . . . The brunt of the withholding-tax increase (from 5% to the full 15%) will be borne by U. S. corporations, which account for about 75% of the foreign investment in Canadian industry.

And the industry affected most will be petroleum. Here is found the biggest single concentration of foreign capital. Sixty-four per cent of the industry is foreign owned, 58% of it by Americans.

Just how much the anticipated $50 million in tax increases will cost an individual company depends on the nature of that company's foreign operations. The U. S. corporation having a Canadian subsidiary as its only foreign operation will suffer the greatest proportionate net loss.

The corporation with several foreign subsidiaries, able to average foreign tax deductions in computing its U. S. corporation tax, will suffer least. It is possible, some have said, to escape any net loss.

The extension of the 15% tax to profits on branches of foreign corporations is expected to lead to a rash of incorporations. The large number of foreign corporations which have set up branch operations only, refusing to "Canadianize," is a source of extreme irritation to Canadians.

These moves have already achieved one major aim: Improving the exchange rate. The premium on the Canadian dollar has dropped almost 2 points to just above par with the U. S. dollar, where it is expected to stabilize.

This alone is almost enough to justify the new taxes in the eyes of the Canadian Government.

It will also place Canadian industry in a better position to compete at home and in the world market. U. S. capital will have more purchasing power in Canada, compared with a year ago.

Then, with the Canadian dollar priced at $1.05 U. S., it took $1,050,000 in U. S. money to buy $1,000,000 in Canadian investment.

The foreign parent will, however, realize less from dividends as a result of deflation.

Motives for changes . . . Although the government moves are being read outside Canada as anti-foreign, principally anti-American, they are designed in the main to put Canada's own house in order.

Canada has been running a deficit in its balance of international payments which it feels is intolerably heavy.

It has made much progress in reducing the deficit on merchandise trade—to just over $100 million in 1960 as compared to the record 1956 deficit of $728 million for all merchandise trade.

But the total deficit is still running at $1 billion a year.

Much of this is in service of imported capital. The drain in dividends and interest is running at about $450 million a year.

Tax changes which will slow foreign investment, offset low interest rates in New York, and stimulate Canadians into investing more at home should move the balance of payments in the right direction.

They should also achieve a corollary goal—equally important to Canada—of reducing the proportion of foreign ownership of industry.

U. S. reaction . . . From the non-Canadian point of view, the tax increases were at best ill-timed.

The oil industry, still in the red

How Foreign Investment Grew in Canada

(Millions of Dollars)

	Total	United States	United Kingdom
1900	$1,232	$168	$1,050
1914	3,837	881	2,778
1918	4,536	1,630	2,729
1930	7,614	4,660	2,776
1945	7,092	4,990	1,750
1956	15,577	11,802	2,668
1957	17,476	13,276	2,918
1958	18,990	14,441	3,067
1959	20,675	15,725	3,250

in Canada, is just beginning to earn a return on its multi-billion-dollar investment—particularly in exploration and production.

Foreign parents have received subnormal dividends. For that matter all Canadian foreign-owned industry, concentrated in such growth sectors as petroleum and manufacturing, has paid subnormal dividends.

There has been a time lag of several years before large amounts of risk capital, which naturally conservative Canadians have been unable or unwilling to provide, began to pay off.

The U. S. oil company is inclined to react privately in this manner: "Now that we've laid out the large sums to give Canada an oil industry, the profits which we had been led to anticipate are being reduced on the eve of their realization."

Canadian view . . . The move was well-timed from the Canadian point of view for the same reasons American owners resent it.

As operations have become more profitable, more capital has been imported and dividends have increased. But this enlarged the trade deficit. All this time, in the view of government officials, foreign capital has been dealt with fairly and has been placed at no disadvantage. Hence no real friend of Canada should now object to measures aimed at righting serious economic problems.

This view was stressed in Fleming's budget speech.

"We will want this (foreign) investment," Fleming said, "in greater or lesser degree, for many years to come. Accordingly we must continue to maintain a climate hospitable to foreign investment in this country.

"At the same time, in view of the basic changes in the world economic environment, and Canada's altered situation, we must reconsider whether we wish, indeed whether we can afford, to give to foreign capital the special attractions and incentives to come to Canada that were appropriate in past years."

The new nationalism . . . What non-Canadians are viewing as an anti-foreign turn, Canadians themselves prefer to call "economic nationalism."

Canada's increasingly grave concern over the extent of foreign ownership of its industry is no news to anyone with the remotest interest in Canadian affairs. The extent of the public hand-wringing that it has inspired recently is surprising to outsiders.

Canada believes that with 35% of its industry foreign owned, and that concentrated in key industries (petroleum 64%, manufacturing 50%, mining and smelting 56% foreign owned), it is in danger of losing not only its economic sovereignty but its political independence as well.

Foreign owners scoff at such fears. But if they ignore Canada's concern it will be at their peril. The pressure for increased Canadian ownership cannot be expected to diminish.

One indication of such pressure: The impending legislation to provide tax incentives to foreign corporations which open wholly owned subsidiaries to Canadian participation. This may be considered a word to the wise. No mandatory legislation is in the works at this time, but it is not ruled out.

Canadian feeling also may be gaged in the imposition of the 15% tax on unincorporated foreign-branch profits. It amounted to a crack-down on a practice which Canada considers less than neighborly. (The oil industry is generally clean on this score.)

Other complaints heard most frequently: Canadians are given no opportunity to buy equity; there are no Canadians in senior management positions nor on boards of directors (oil is again cleaner than some other industries): subsidiaries often don't contribute to local community chests, even—in some cases—when they are the dominant business in a small town. This latter point apparently rankles much more than the foreign parent realizes.

The observation of one responsible Canadian last week is pertinent here. He said, "In the past you've told us that if we didn't like the way you were operating, we should change the laws. Well, we've changed some laws."

Imports controls coming? . . . Does increasing nationalism in Canada mean a retreat into protectionism?

Is it likely to express itself in imports controls or other government action to give Alberta producers the Montreal market now supplied entirely by foreign crude?

The answer to the question as to the likelihood of oil-imports restrictions seems to be "no." That the question is even asked surprises sources in and close to the government. They cite Fleming's repeated support of free trade in the budget.

More explicitly, these sources say, it would be suicide for an exporting nation, vulnerable as it is to retaliation, to take action against a major imported product.

It would be more consistent, the sources think, for the government to take some indirect action to strengthen the domestic producing industry: A tax, perhaps, or a tariff which would expand domestic crude markets in eastern Ontario now supplied from Montreal - refined imports.

A government decision is imminent and the accuracy of this reasoning will soon be determined.

WORLD'S DEEPEST OPEN HOLE SUCCESSFUL TEST

EXPANDING SHOE WALL PACKER

RUN FOR THE GRANDE CORPORATION

by HALLIBURTON

Russell Holman, Operations Manager for The Grande Corporation, not only had an 18,008 ft. open hole to test — it had also been whipstocked to a deviation of 36° from vertical. This, then, was his problem . . . and he called Halliburton to help him solve it.

DESIGNING THE STRING

Mr. Holman, working with Halliburton Division Engineer, Bill Hinchliffe, and Tester, Erie Miller, designed a testing string composed of the following:

- 3½" A.P.I. Full Hole Handling Sub and Choke Assembly
- 5" Dual Closed-In-Pressure Valve
- 5" Hydro-Spring Tester
- Two BT Gauges in AP Running Cases
- Jars
- VR Safety Joint
- #2 Expanding Shoe Wall Packer Assembly with 5¾" O.D. 15" long 90 durometer Packer
- 198' of 4½" Flush Joint Perforated Anchor

PLANNING PAYS OFF

Probably the most difficult part of running this test was the task assigned to the Packer. Mr. Holman's decision to use a Halliburton Expanding Shoe Wall Packer proved to be a good one. The hydrostatic mud pressure above the Packer was 12,354 psi. The packer not only supported this extreme load successfully — but it wasn't even slightly damaged in doing so.

Another interesting aspect of this job was the ability to rotate 17,810 ft. of 3½" drill pipe in the 36° off vertical hole to operate the Closed-In-Pressure Valve — which operated flawlessly.

RESULTS OF THE TEST

The successful testing of the potential productivity of the Oil Creek Formation in the 17,810-18,008 ft. interval materially assisted The Grande Corporation in determining post-drilling planning for their Harshbarger No. 1 in Grayson County, Texas.

The new record for a successful open hole test was set by Halliburton on an 18,008 ft. Grande Corporation well in Grayson County, Texas.

Experience counts . . and Erie Miller has sixteen years with Halliburton as a Tester. He is shown here with The Grande Corporation's Superintendent, Mr. H. B. Eppler, inspecting the 15" Expanding Shoe Wall Packer used in making the record test.

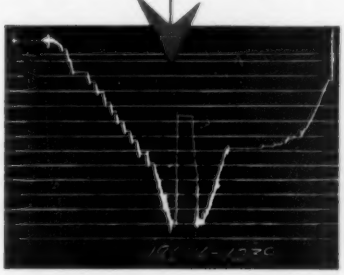


Chart recorded by Halliburton BT Gauge with C.I.P. Valve in the record test.

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FPC Outlook: Kennedy Majority by Midyear

• Two new appointees already picked, and a third will be named to succeed Arthur Kline, Kennedy's associates say.

AN announcement is expected soon on two appointments to the Federal Power Commission.

The men reportedly have already been chosen, but their names have not been made public.

"The industry should not be shocked nor dismayed by the selections," a source close to the Kennedy administration said last week. "The men chosen are highly qualified."

Neither of the two spots will go to William R. Connole, a former member who President Eisenhower refused to reappoint last summer.

Connole's name has frequently cropped up in speculation on the appointments, and there have been some "major" reforms he has advocated. That is, Connole seemingly did not want the job unless he were to be made chairman, with broad indications that Connole was approached at one point to determine whether he would be interested in returning to the commission.

Apparently Connole replied that he would not be unless he were given an opportunity to institute authority.

Connole has told friends that he likes the work he is doing now as a Washington attorney and that nothing less than an opportunity to play a key role in the overhaul of the commission would entice him to return to government service.

The Kennedy advisers, aware that selection of Connole for the top post at the FPC would arouse controversy, decided against such a move.

The two new appointments to be made are to fill a current vacancy on the commission and to replace Commissioner Paul A. Sweeney, who is serving an interim appointment.

In addition, the term of Commissioner Arthur Kline expires June 22, and it is a foregone conclusion that he will be replaced. Thus, by midyear, Kennedy will have appointed three new members—a majority—to the commission.

This switch in a majority may very likely lead to changes in policies and interpretations of policies affecting regulation of natural-gas producers.

Who Will Reorganize Regulatory Agencies?

• Kennedy's actions say regulation is an executive branch function, but Congress may decide to maintain control.

ANY major overhaul of federal regulatory agencies may be delayed by a tug of war over who is going to do the overhauling.

Both the incoming administration and some members of Congress have shown signs that they intend to do it.

A congressional committee last week suggested changes and proposed that a permanent congressional subcommittee be set up to ride herd on the agencies.

Earlier, reform proposals were made by James M. Landis, appointed by President-elect Kennedy to be his chief adviser on regulatory matters (OGJ, Jan. 2, p. 50).

Landis' proposals call for a congressional grant of broad powers to the President to make sweeping changes by administrative action.

The net effect would be the establishment of a regulatory "czar" within the administration rather than the establishment of a congressional committee to supervise the agencies.

The issue of whether Congress or the President should have the upper hand in dealing with regulatory matters is certain to arise when legislative proposals drafted by Landis are submitted to Congress.

Most Washington observers feel that Congress will be slow to give away any of its authority.

If Congress decides to call the signals itself, proposals made by the legislative oversight committee may be used as the blueprint.

The committee last year held a series of hearings on the regulatory agencies.

The report . . . The committee's report last week was along much the same lines as a report issued earlier by the committee's staff (OGJ, Dec. 26, p. 81).

In addition to proposing formation of a permanent watchdog committee, the legislative oversight committee called for tighter rules on "ex parte" contacts with commissioners by industry representatives after hearings on a case have been held.

It also suggested that the FPC be divided into two branches, with one assigned exclusively to handle natural-gas cases and the other to supervise electric power and other matters.

The committee, like the committee staff, cleared Thomas G. Corcoran and Tennessee Gas Transmission Co. officials of any improper action in the Midwestern case last fall. However, a Republican minority on the committee issued a separate report, terming this a "whitewash."

Hearings ahead . . . Because of differences in proposals made by Landis and by the committee, and because of the struggle over who will supervise the regulatory agencies, a clash seems inevitable when Congress begins consideration of actual legislation.

Congressional hearings on the issues will no doubt provide a clearer indication of the regulatory philosophy and direction of the new administration.

The hearings will also provide other interested parties, including the oil industry, an opportunity to present their views.

And such hearings will give the agencies, themselves, an opportunity to defend themselves and to present their own ideas for reform.

The Federal Power Commission, for example, can point out that it has

repeatedly asked Congress for legislation which would help speed up its disposition of gas cases. Having failed to get Congress to do this, the FPC has gone along doing the best it can, its officials insist.

Commission members feel that they are currently being used as whipping boys and that, actually, they already have done much to improve their efficiency.

At any rate, the months ahead are likely to shed some light on what lies ahead for natural-gas producers and others who fall under some form of federal regulation.

Mueller turns down request of equipment men for foreign credit

A PROPOSAL by oilfield equipment suppliers aimed at stepping up their sales abroad has been turned down by Commerce Secretary Frederick Mueller.

The equipment suppliers, in a December meeting with Commerce officials, had urged that rules of the Export-Import Bank be revised to permit long-term credit on oil-field machinery and equipment sold abroad (OGJ, Dec. 12, p. 78).

Under existing regulations, the Export-Import Bank cannot take such action if the sales are to a country whose oil industry is under government control.

Oil-equipment representatives pointed out to government officials that this rule does not apply to other industries, only oil.

They said they could compete effectively with foreign firms if government-backed credit terms were made available.

Mueller was not convinced. He said last week that such a move would be poor policy for the Government because there is plenty of private capital available for development of foreign oil resources.

Anyway, he said, there already appears to be too much oil in the world now, causing a glut on the market, and that U. S. Government action which would worsen this condition would be unwise.

He said further that the Government should not extend loans or credits to governments that have expropriated American oil holdings, or who may do so in the future.

watching WASHINGTON

Clyde La Motte

• Like it or not, major changes are on the way . . .

WATCH THE CHANGE in pace and tone of Washington developments, now that a new administration is moving in.

There will be no sudden shift in direction, nor evolution of radically new policies. But there will be fresh urgency, more experimentation, more effort to establish broad planning patterns.

Oil will need to recognize this, be ready for it. It will not be enough to play a waiting, defensive game. The new administration is hungry for ideas, impatient for action.

Oil's best bet, then, is to be ready to swing to the offensive on key issues. For, if changes are to be made, the industry should try to have a hand in shaping those changes.

Take the regulatory agencies. The administration wants to overhaul them, and the Federal Power Commission is high on the list.

Congress, too, has been eying the agencies. It will try to beat the administration to the punch by getting to work on the overhaul job itself. That way, it could continue to hold much of the control rather than letting this power fall into the hands of the executive office.

The coal industry, state and local regulatory commissions, and others will be pressing their own recommendations.

But the oil industry is more directly affected than anyone else by the course the FPC takes. Therefore, the industry had better develop some positive proposals of its own—and quickly.

This does not mean that major changes in the regulatory agencies will occur soon. But the move to do so will. And if oil waits too long it will be on the defensive again, finding fault with proposals of others rather than advocating a program of its own.

• Someone is going to shape new energy policies . . .

OIL NEEDS to be alert on other fronts, too. Watch for early moves to develop broad energy policies and to coordinate more closely the work of the various government agencies dealing with some phase of energy development or use.

Oil can stand fast to its position that such action is not needed, or it can prepare some suggestions of its own.

If it chooses to stand pat, and changes are made anyway, oil will have little voice in them.

• Oil still has time to get its own plans ready . . .

THE BRIGHT SIDE of the picture is that there will be time for oil to choose its course and to map its tactics.

Ready as the Kennedy Administration is for action, it will do little shooting from the hip. Even should it try, Congress will slow it down.

Some Washington observers feel that the real showdown will not come until 1962, or even later on many issues. It will take that long, they feel, for the new administration to get key programs in motion.

But the preliminary maneuvers, the jockeying for position will begin at once. Alignments will begin taking shape in the months ahead. Targets will be set, and concessions planned.

Rapid or slow, major changes lie ahead. And oil will change, too, either on its own or by pressure from the outside.

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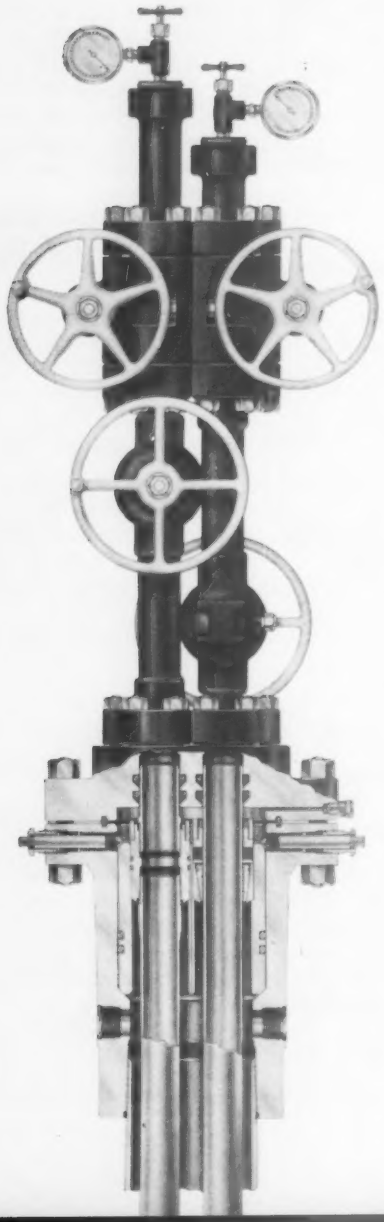

The challenge was tubingless completion equipment featuring simplicity, flexibility, utility and "controllability." And here is the answer.

- Hangers are interchangeable. Thus, one, two, three or four strings of tubing can be hung in a head simply by changing hangers. Moreover, screwed or slip type interchangeable hangers are provided. Regular hanger couplings can be provided with or without the back pressure grooves.
- The complete series of hangers is produced to fit O-C-T Type CM, C-18, or C-19 Casing Heads and hangers for C-18 and CM heads are interchangeable. All hangers are designed to allow conventional cementing procedures, even providing for reciprocation of the tubing while cementing and simultaneously cementing through two or three strings of tubing.
- The Christmas Trees for use with O-C-T tubingless completion equipment can be provided with screwed connections, individually flanged connections or block type valves in the case of duals, triples or quadruples.
- For use with the several types of trees, O-C-T manufactures a complete line of 2½-inch tubing heads in which ¾-inch through 1½-inch tubing can be hung with any one of a complete family of interchangeable hangers.
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Monsanto's Goal: Big Complex

MONSANTO Chemical Co. has made a dramatic move toward manufacturing more of its own intermediate chemicals.

It will build the world's largest ethylene unit — capacity over 500 million pounds annually—and other units on part of a 3,000-acre site on Chocolate Bayou near Alvin, Tex., south of Houston. The plant will begin operating in 1962.

The company optioned the 3,000-acre site early in 1960 (OGJ, March 14, 1960, p. 108) but did not announce plans until last week.

Final selection of the site was based on the availability of water transportation, feedstocks, and the short distance—25 miles—to its Texas City plant, where a major part of the ethylene will be consumed.

Monsanto, a large consumer of hydrocarbons, began in 1955 to supply more of its intermediate chemicals when it merged with Lion Oil Co., a petroleum producer, refiner, and marketer. The new plant is another step toward self-sufficiency in hydrocarbon raw materials. However, after completion, Monsanto will still be a net purchaser, the company said.

Natural gas from Monsanto's Lion Oil Division will be used for fuel in the new plant. Lion also will provide some of the liquid feed stocks.

The Chocolate Bayou plant will produce, in addition to ethylene, 42 million gallons yearly of benzene, 50 million pounds yearly of napthelene, and unannounced amounts of propylene, cumene, phenol, acetone, ethyl benzene, and other hydrocarbons.

H. K. Eckert of Texas City, former assistant general manager of the company's plastics division, is general manager of the Chocolate Bayou project.

Bechtel Corp. is prime contractor for the plant, located on 550 acres of the 3,000 acre site.

Oklahoma Gives Wide-Spacing Allowable

A SPECIAL oil allowable for voluntary wide spacing has been granted by the Oklahoma Corporation Commission in two cases in the Oklahoma Panhandle.

This is the first time the state has given an allowable bonus for 80-acre spacing. Normal allowables are based on a maximum spacing of 40 acres.

In both cases all working and royalty interests agreed to 80-acre spacing, although the operations were not formally unitized. The allowable granted is 28 bbl. per day, flat, and will not fluctuate with changes in market demand. The current allowable for wells in this depth bracket on 40 acres is 17 bbl.

After hearings, the commission determined that one well will drain 80 acres effectively. Closer spacing, it said, would create economic waste.

The two special orders apply to nine wells in Beaver County operated by Caroline Hunt Sands and Loyd B. Sands and by Graham-Michaelis Drilling Co.

Marketers Planning Appeal

CONVICTION of 12 marketing companies on federal price-fixing charges in South Bend, Ind., will be appealed, at least by some of the firms.

Both Texaco Inc. and Standard Oil Co. (Ind.) said there was no conspiracy to fix gasoline prices, as the Government insisted, and that they were convinced an appellate court would overturn the verdict.

The conviction was returned by a jury of 10 women and 2 men that deliberated for 7 days. A hearing on motions for a new trial was set for January 23.

Besides Texaco and Indiana Standard, defendants included Mobil, Phillips, Gulf, Cities Service, Hudson, Tornado, Central West, Ohio, Pacer, and Shell. Sun Oil Co. was granted a directed verdict of not guilty in mid-December.

PROCESSING BRIEFS . . .

Petro-Tex Chemical Corp., Houston, is building a tetrahydrophthalic anhydride unit. The unit is scheduled for completion in October, along with Petro-Tex's 30-million-pound yearly maleic anhydride unit. When the maleic unit is finished, Petro-Tex will make both starting materials, maleic anhydride and butadiene.

New refining units are planned for the Murphy Corp. refinery at Superior, Wis. Included in the construction program are a fluid catalytic cracking unit of 5,000-bbl.-daily capacity, a 1,200-bbl. hydrofluoric acid alkylation unit, construction of 200,000 bbl. of additional tankage, and a new TEL blending plant.

The Southern Gas Association has discontinued a short course in gas technology offered annually for 15 years at Texas A & I College, Kingsville. Association President James A. Wilson said functions performed by the course are now being served by other association activities.

A products terminal at Great Falls, Mont., has been completed by Continental Oil Co. The $474,000 terminal has a capacity of 7,980,000 gal. and will receive products from an 82-mile spur line completed recently from Helena to Great Falls by Yellowstone Pipe Line Co.

Ehtylbenzene separation facilities able to extract 30 million pounds of product yearly from a mixed xylene stream, will be built at Suntide's Corpus Christi refinery. Badger Mfg. Co. will handle design, engineering, and construction of the unit.

A CO boiler with a generating capability of 165,000 lb. per hour and a 6,000-hp. extraction steam turbine will be added to British American's fluid cat unit at Clarkson, Ontario. Contractors are Combustion Engineering, Inc., and Canadian Westinghouse Co., Ltd. Completion is set for next fall.

Wide Spacing Is Still the Rule in North Dakota

NORTH DAKOTA is still the oil industry's champion of wide spacing.

The state has almost completed 10 years as a producer. Its oil-well spacing score to date:

7 pools on 40 acres.

44 pools on 80 acres.

32 pools on 160 acres.

3 pools on 320 acres.

Of the eight oil pools discovered in 1960, three are spaced on 80 acres, four on 160 acres, and one on 320 acres. Still another—the Madison pool of Clear Creek field, which had been on temporary 80-acre spacing since its discovery in October 1958 — on January 1 this year was placed under permanent 160-acre spacing.

The year-end report of the Oil and Gas Conservation Division puts 1960 production at 21,865,000 bbl., compared with 17,960,000 for 1959. Spreading it over the state's 1,450 producing oil wells, this means an average per-well output last year of a little more than 40 bbl. daily.

North Dakota started out with a conventional statewide 40-acre spacing pattern. Field rules are set after 18 months or five wells. The state now follows the policy that "it is sheer folly to drill on 40 acres when it isn't absolutely necessary to recover the oil." (OGJ, Nov. 9, 1959, p. 106.)

Since then, the conservation division feels, wide spacing has reduced drilling costs per barrel of reserves by at least 50%. It has also brought more oil money to the state, by offering better economics, and has resulted in more wildcatting and more discoveries than would have been possible to obtain from closer spacing.

Octane Increase in '60 Smallest in 9 Years

- Gasoline ratings held almost steady last year although less lead was used. Refiners achieved this by shifting alkylates from avgas.

GASOLINE OCTANES remain about the same as a year ago, but it's taking less lead to keep them there.

Ethyl Corp.'s nationwide survey for December shows an average research octane rating of 92.6 for regular, up 0.2 from a year ago. Premium remains at 99.3 the same as in 1959. The annual growth is the lowest registered since 1951.

Average lead requirement for 1960 premium gasoline was 2.45 ml. per gallon, a decrease of 0.05 ml. Requirements for regular remained the same at an average 1.71 ml. per gallon.

The changes in lead reflect the easing of the octane race. Refiners are shifting alkylate which formerly went into avgas into their premium grades. The resulting increase in hydrocarbon octanes lessens the need for boosting octanes with lead.

Sensitivity, the difference between research and motor octanes, declined again last year after a sharp drop in 1959. Although premium was 99.3 RON for both 1959 and 1960, motor octane number crept up from 89.4 to 90.0—resulting in a sensitivity decrease of 0.6. The change is a reflection of the increasing quality of premium beefed by refiners with cleaner burning isoparaffins.

Although there was a lull during 1960, octanes are expected to push higher this year. And the octane spread which separates premium and regular now—6.7 RON—is expected to narrow further. Roughly 65% of the car population is satisfied by regular gas at the trace-knock level. Some 80% get along on regular at the light-knock level.

If refiners are to continue to satisfy the same percentage of cars with regular, they'll have to boost it about 0.6 RON per year, according to various industry estimates. At the same time, premium will have to move up only 0.5 RON per year to satisfy hot-car needs.

Regional picture . . . Quality of Gulf Coast regular showed the greatest improvement during the year. It's up an average of 0.6 octane numbers over 1959. But, at an average rating of 91.3, it still lags behind the national mark by 1.3 and it's well behind the East Coast average of 94 RON.

The December average for West Coast premium has inched above 100 for the first time. The Los Angeles and Seattle areas averaged 100 in 1959, but last year Portland and San Francisco moved up to join the leaders. The 100.1 mark set on

PIPELINE

Columbia Gulf Transmission Co. is seeking an FPC permit to spend $15 million to increase capacity of its 841-mile line from Rayne, La., to Catlettsburg, Ky., from 666 to 718 million cubic feet daily. It would loop 97 miles of its main line and build 29 miles of 12-in. lateral supply line in Louisiana. The company delivers gas to its parent Columbia Gas System for distribution in southeastern and eastern states.

A $2-million pipeline construction job will be launched by Sunolin Chemical Co. this spring. Spanning the Delaware River from Claymont, Del., to a point north of Penns Grove, N. J., ten 8-in. lines will

the West Coast is well above the national average of 99.3, and it tops the East Coast average of 99.5 for premium.

Although the West Coast leads in the premium department, it trails the rest of the nation in regular octanes. Average West Coast regular is 90.9, which is 1.7 numbers off the national pace. And it trails the Gulf Coast, which posted last year's low, by 0.4 RON. Likeliest change will be an improvement in both areas during 1961.

Mobil renews Santa Monica offshore deal despite drilling ban

MOBIL OIL CO. is keeping alive an offshore exploration contract it has with the California resort city of Santa Monica despite city rules against drilling in the tidelands.

The renewal came as a slight surprise since Santa Monica voters last summer turned down a proposal which would have permitted Mobil to drill the tidelands acreage.

When Mobil signed the 10-year contract, it set aside $500,000 to pay the city at the rate of $50,000 a year. So far it has paid Santa Monica $300,000. If the drilling ban is lifted, the remainder of the money goes to the city. But if Mobil cancels, it gets what money is left.

Double Tank Improves Ammonia Storage

A NOVEL tank-within-a-tank which can hold 7,000 tons of anhydrous ammonia is being completed at the U. S. Industrial Chemicals Co. plant in Tuscola, Ill.

Ammonia will be stored in the inner tank, 88 ft. in diameter and 56 ft. high. This tank will be surrounded by 2.5 ft. of insulation. An outer tank will keep the insulation dry.

USI is using a relatively new technique in the double-tank storage system. Refrigerated ammonia can be kept at atmospheric pressure instead of being stored in pressurized tanks at moderate temperatures.

In the inner tank, the ammonia will be maintained at a temperature of −28° F. by surface evaporation of the ammonia itself. The evaporated ammonia will be recompressed, condensed, and recirculated to the tank.

The company is a division of National Distillers and Chemical Corp.

BRIEFS . . .

transport products from the company's $20-million ethylene-oxide plant now being built at Claymont.

A contract to build an 82-mile 8 and 10-in. gas line in Austria has been signed by Williams Brothers Co. The line will connect Traismauer and Amstetten, and will be owned and operated by NIOGAS.

Construction of three sections of 30-in. line is called for in contracts let by Trunkline Gas Co. One line will be north of Effingham, Ill., and the others—each 20 miles long—will be laid in Louisiana, near Grove and near Rayville. Cape Construction will handle the Illinois section and Panama-Williams Corp., the two Louisiana sections.

A 64-mile extension of the Great Northern Pipe Line Co. system is planned for this year. The company, a wholly owned subsidiary of Great Northern Railway, will push its system northwest to the Lignite field, Burke County, North Dakota. Its 50-mile line from Newburg, Wiley, and Glenburn fields of Bottineau County to Minot, N. D., was completed in December and the new project was put on the schedule.

Also for Pipeliners . . .

IN THE NEWS: California gas projects now in the works would increase flow into state by 70% (p. 46) . . . Texas firm files permit to build helium-extraction plant (p. 48) . . . Kennedy expected to win majority position on FPC soon (p. 52) . . . One big issue arises in Washington over who will control the regulatory agencies—Congress or the President? (p. 52).

PLUS THIS TECHNICAL REPORT: How to combat high corrosion-control costs (p. 72).

Brazilian Oil Picture: Hopeless, Says Topflight

• Walter Link's glum report to Petrobras on his 6-year hunt for oil stirs up a sticking to his belief that further exploration in Brazil is a waste of money.

BRAZIL, which has one of the largest sedimentary basin areas of any country in the world, probably will never produce enough oil to meet its own needs unless new oil-discovery tools are developed.

That, in essence, is one man's evaluation of one of the biggest question marks in oil exploration today. Private oil companies have coveted Brazil's large sedimentary basins for years, thwarted by jealous nationalism that wouldn't allow them to even look.

Walter Link, one of the world's top exploration geologists, returned to the United States last week after spending 6 years in a search for Brazilian oil. He not only wouldn't recommend that a private oil company spend exploration money in Brazil, he also advised Brazilians to "stop pouring money down a rathole."

Link made public his final reports to the board of directors of Petroleo Brasilero, the government-owned oil exploration and producing monopoly in Brazil—better known as Petrobras. Link, who headed exploration for the enterprise, and his associate geologists reluctantly painted a pretty dreary picture of Brazil's chances of becoming self-sufficient in oil.

In revealing the findings, Link made it clear he was doing so only because his "confidential" report to the Petrobras board has already appeared in a number of Brazilian newspapers.

Publication of the report brought a number of fanatical denunciations of Link from extreme Brazilian nationalists. They accused him of deliberately sabotaging the Brazilian effort because he is the "tool" of private capital.

The attacks also caused a number of the more stable and conservative Brazilian newspapers and political leaders to spring to Link's defense.

The so-called Link Report to the Petrobras board actually was the concensus of 14 geologists employed by the Petrobras exploration department. Six of the group are Brazilians and eight are foreigners. The report, dated August 22 and addressed to Gen. Idalio Sardenburg, president of Petrobras, suddenly appeared in its entirety in several Brazilian newspapers in November. Top Petrobras officials have professed ignorance of how the confidential report was "leaked" to the press.

In the report, the 14 geologists rated Brazil's 12 major sedimentary basins on an "A, B, C, and D" basis and recommended that no more exploratory money be spent in most of them because of the negative results obtained in the 6 years of work.

Not one of the basins was rated "A." Only Sergipe Land, the region where the Reconcavo Basin in Bahia produces Brazil's only commercial oil, was rated as high as B-plus. The geologists advised that development work be continued here and in the adjoining Tucano Basin, which has had some encouraging oil shows recently.

In a subsequent individual report to the Petrobras board in November, Link pointed out 12 additional failures in the massive Amazon Basin, four more dry holes in the Sergipe-Alagoas Basin, three more in South Brazil, and another in South Bahia.

"There is no geological justification for spending another $20 million in these basins in 1961," Link wrote the board. "The hope that oil might be accidentially discovered is very small and cannot be scientifically or technically justified."

It was this pessimistic vein in both reports that drew the fire of Brazil's most rabid nationalists. The fire reached its zenith November 22 on the floor of the Chamber of Deputies when Gabriel Passos, a member, charged that Link deliberately sabotaged the Petrobras exploration effort because he was still serving as a vice president of Standard Oil Co. (N. J.). Passos charged that Link always ordered "drilling stopped as soon as indications of oil were noted."

Passos went so far as to say that Link was originally hired by Petrobras in 1954 through a mistake. The deputy said Petrobras meant to employ Link's brother Theodore, also a prominent geologist.

"I haven't talked to Ted about this," Walter Link said with a smile at an interview last week. "He may agree with Passos."

The charges against Link became so virulent that Juracy Magalhaes, governor of the State of Bahia and the first president of Petrobras, came to Link's defense publicly and countered them.

Magalhaes assured Brazilians that he and everyone connected with Petrobras had the highest respect for Link's integrity and professional ability when his original contract was signed and that nothing had happened in 6 years to cause him to change his mind.

If Link's geological conclusions about Brazil are correct, the country faces an acute energy problem. Brazil is developing rapidly from an industrial standpoint and is manufacturing automobiles at the rate of 100,000 a year. With no coal or other energy source, the nation depends solely on oil for both industrial power and transportation.

The Reconcavo Basin fields, which the Link report recommended be developed further, produce Brazil's only oil. Last year, Link estimates, these fields averaged about 85,000 bbl. daily. They pushed

U. S. Geologist

whirlwind of criticism. But he's unless new techniques are devised.

daily production over the 100,000-bbl. mark for one day late in December.

In contrast to that production, Brazil has more than 200,000 bbl. daily in refining capacity today. Another 90,000 bbl. daily will be added in February when a new Rio de Janeiro refinery is completed.

Petroleum consumption in Brazil is already more than 300,000 bbl. daily and increasing all the time.

Link's analysis . . . With the exception of the development of the Reconcavo fields, Link figures Brazil has spent from $250 million to $300 million in the past 6 years drilling more than 200 wildcat wells without finding any new oil.

This, plus the geological findings of those 6 years, is enough to make Link pessimistic. He prefaced his Petrobras report with a summation of the feeling of an exploration geologist, saying "it is always with the greatest reluctance and feeling of personal failure that he must face the decision to condemn an area in which hopes of finding oil were once high, but where results have been negative."

Link said his pessimism is based on the fact that "every instrument and tool possible was used, plus the finest geophysical brains."

"The geology of Brazil is such that these things just won't work," he added.

"They may find oil in Brazil, but not economical production. Maybe in 10 years when methods improve it may be different, but not now."

Link ticked off Brazil's sedimentary basins on his fingers and pointed out that the big South Brazil Basin's sedimentary beds are 95% covered by lava beds ranging from 650 to almost 2,000 ft. thick. The same condition is true in the big Marhanhao and Amazon Basins.

::There's no place in the world where oil is found under these conditions," Link says. "There are no structures.

"If the politics of Brazil were as stable as its geology it would be a wonderful country.

"Add all the necessary geological factors you need to find a commercial oil accumulation in Brazil, and you come up with zero."

Link does believe that Petrobras exploration efforts under his direction accomplished a lot for Brazil. He points out that the Bahia fields which can now be pushed to 100,000 bbl. daily were producing only 2,400 bbl. daily in 1954. At that time reserves were rated at only about 150 million barrels. Today, he says they are between 600 and 700 million.

Petrobras itself . . . To complicate a difficult and expensive geological picture, Petrobras has become the plaything of nationalistic politicians. None of the present board members are technical or oil men.

"It's the biggest corporation in Brazil and it's being run by amateurs," Link commented.

"Oil is not Brazil's biggest problem. It's politics. It's not a unique situation, but it's not a successful oil situation either."

Link's Smarting, But Still Likes the Brazilians

WALTER LINK, tall, slim and graying, left Brazil last week for the United States and his hometown of La Porte, Ind., where he plans to hang up his shingle as a consulting geologist.

Link took on the job as head of exploration for Petrobras in 1954. He had been chief geologist for Standard Oil Co. (N. J.) and spent 29 years with Jersey as a working geologist over most of the world. He left his vice presidency with Jersey reluctantly because he had to give up his seniority. But, the $500,000 figure for a 5-year contract lured him to Brazil.

He wound up his work for Petrobras December 31, after agreeing to extend the contract for a full year at the end of the first 5 years.

Outspoken and direct, Link was obviously smarting last week because of the lambasting he took in the Brazilian press for doing what he regards as his best to find oil in a country where the geological odds were against him.

"I didn't quit. I wasn't fired. My contract was finished and it was finished at the date I specified," he said last week. "I'm not mad at the Brazilians and I don't think they're mad at me."

"The Brazilians are nice people. I like them very much. We enjoyed our stay—we even adopted two Brazilian children, 10 and 12 years old.

"The Brazilians are not oil people or oil businessmen. I can like them, but I don't have to agree with them."

Link started his professional career as a geologist with the old Standard Oil Co. of Venezuela in 1925. His next assignment was with the forerunner of what is now Jersey's half of Standard-Vacuum in Indonesia. Then he jumped back to Oklahoma with Carter Oil, spent some time in Louisiana and went to Colombia before transferring to New York where he eventually took on the top geological post for Jersey.

"I'm a geologist and always have been," he said last week. "Don't ask me questions about politics or marketing or anything like that. I'm a geologist."

Attacks on Venezuelan Oil Policy Get Sharper

• Perez Alfonzo says the pressure is aimed at weakening the united front of oil exporters who meet in Venezuela soon. The outlook for this OPEC conference and unified action on world proration is clouded.

DR. Juan Pablo Perez Alfonzo, Venezuela's oil minister, is a little like a socialite awaiting the arrival of important garden-party guests while the skies overhead get darker and more threatening.

Perez Alfonzo soon will play host to Middle East members of a newly formed group of oil-exporting countries. He was a moving force in the creation of the group. Its first formal meeting is slated in Caracas, January 15, to work out common oil policies for his own country and Middle East producers.

When the four Middle East members of the Organization of Petroleum Exporting Countries arrive in Caracas they will find their host under fire on the home front because of the oil policy he has evolved for Venezuela.

The Venezuelan oil minister has seen the handwriting on the wall for several weeks now. He has publicly blamed "a strong international offensive" for the increasing pressure on his domestic oil policy.

Late last month he said this "offensive" probably would increase before next week's meeting in order to put more pressure on oil prices and weaken the united front of the producers.

In contrast to Perez Alfonzo's position, at least two of the Middle East representatives scheduled to attend the meeting are in stronger positions in their own countries than ever before.

Abdullah Tariki, formerly director general of Saudi Arabian oil affairs and a co-architect in the formation of OPEC, goes to Caracas with his newly acquired ministerial rank (OGJ, Jan. 2, p. 64).

Mohammed Salman, the new Iraqi oil minister, presumably will represent Iraq at the OPEC meeting. Salman, former secretary of the Arab League's oil committee, attended the previous OPEC meetings at Baghdad but on an unofficial basis.

Two other members of the original OPEC group may arrive with second thoughts about some of its initial aims.

Faud Rouhani represented Iran at the group's formation sessions in Baghdad last September. Since that time the Shah of Iran has said for publication that any scheme for international proration of oil production (theoretically one of OPEC's aims) is impractical. The Shah, in fact, insists that Iran must keep increasing its production until it regains its position as the No. 1 producer in the Middle East.

Ahmed Sayid Omar, Kuwait's deputy director of finance who headed the Kuwait delegation at Baghdad, recently expressed doubt that a proration system would work effectively.

OPEC aims . . . The resolutions drawn up in the 4-day September meeting at Baghdad and later adopted by the governments of all five countries form the basis for the Caracas meeting.

These include:

. . . Demands that oil companies maintain stable prices with the added proviso that the members "by all means available to them" restore prices to the level maintained before they were cut in August. Perez Alfonzo has succeeded so far in keeping the price reduction from spreading to Venezuelan crudes.

. . . Consultation by the oil companies with the producing countries before any change is made in the posted price of crude.

. . . Some system to insure stable prices—if necessary, by regulating production.

Any such regulation of production, OPEC says, would be carried out with due regard to both the producing and consuming nations to insure a steady income to the former countries and a regular energy supply to the latter. Such a plan also would keep in mind a fair return on the capital invested in the oil industry.

Perez Alfonzo's problems . . . The host for next week's meeting has already embarked on a similar policy for the Venezuelan oil industry. He is now the target of increasing criticism because many in Venezuela blame his oil policy for the straitened financial situation that has all but crippled the country's economy.

The oil minister replies that this criticism is part of the international offensive aimed at discrediting both him and OPEC, but he has yet to name those behind such an offensive.

The tempo and sources of criticism have increased in recent weeks.

One Caracas daily newspaper last month suggested that the oil minister could best serve Venezuela as ambassador to the Middle East.

"New men and new methods are necessary," Los Esfera commented.

Both Perez Alfonzo and his president, Romulo Betancourt, have long insisted that no more exploration concessions would be granted in Venezuela. Perez Alfonzo states publicly that he has no desire to see Venezuela try to maintain its market position in the oil industry.

He has insisted that a steady 4% annual increase in production would suit him fine. And he has clamped down on hard-pressed oil companies which tried to market production by granting price discounts. The latter move drew threats of a shutdown for offending companies operating in Venezuela.

The Caracas Chamber of the Petroleum Industry, an organization supported by private companies operating in Venezuela, has often criticized the Perez Alfonzo oil policy as repressive.

Last week in a year-end report, the chamber presented these points about Venezuelan oil in 1960:

. . . A production increase of about 3% for Venezuela in contrast to the 4% target of the oil minister. The chamber compared this increase to 14.4% for Russia;

20% for Indonesia; 14.3% for the Middle East; and 35% for Argentina.

... **A decline in drilling** activities with only 410 wells completed in 1960 compared with 690 in 1959 and 1,813 in the peak year of 1957.

... **A slump** in geological and seismic activities which dropped 10% below the level of the past 8 years.

... **Reduced capital investments** because of the depression in drilling and exploration.

... **Lost markets** in Cuba and Argentina, plus losses in Brazil to Russian crude supplies.

... **A market gain** of 6.5% in Canada and a holding action in U. S. markets.

The declines listed above also have alarmed the National Economic Council, a governmental advisory body. Last month the council asked the administration to make a radical change in its oil policy.

The council said the government's policy has not helped the oil industry in Venezuela but, "on the contrary," the policy has not successfully dealt with "the international oil marketing problems that exist today."

The council recommended that the government revise its policy to give the oil companies "greater flexibility" to meet needs.

Two Indian Fields Open Soon

. . . but with a daily flow some 20,000 bbl. under original estimates. Output will go to a new refinery at Gauhati.

NAHORKATIYA and Moran oil fields in upper Assam will open with an initial capacity of about 30,000 bbl. daily.

Oil India Private, Ltd. estimates this level, about 1.66 million tons per year, will be available from existing wells when a 260-mile 16-in. crude pipeline to a new refinery at Gauhati opens late this year. A 460-mile 14-in. extension will be built to Barauni, Bihar, where a second refinery is planned.

Equipment to build the two pipelines is en route to India. SAIPEM, a member of Italy's ENI group, is handling the shipment and reportedly will supervise construction.

The equipment includes two large cranes, crane-equipped bulldozers, collapsible bridges for the 83 river crossings that must be made, jeeps, trucks, pumps, and compressors. SAIPEM is working with Mannesmann Co. of Dusseldorf on the project.

It was not learned immediately whether output might be raised after studies are made under operating conditions. Earlier estimates placed the capacity of the two fields at 2.75 million tons per year, or better than 50,000 bbl. daily.

A total of 68 wells has been completed in Nahorkatiya and Moran as oil or gas producers. A dozen wells were dry holes. Six wells are awaiting further test. Nine more drilling locations are being prepared.

The fields were discovered by Assam Oil Co., a subsidiary of Burmah Oil Co. Assam Oil since then has been taken over by Oil India Private, a rupee company in which the government has one-third interest.

In another operation, in western India, the government says that discoveries of oil at Ankleshwar, near Baroda, north of Bombay, still remain to be proved commercial. Initial tests on Ankleshwar 1 indicated a 2,100-bbl.-daily well, and plans were made for 10 stepouts by the end of 1961 (OGJ, Nov. 11, p. 157).

Ankleshwar is about 100 miles south of Cambay, where commercial output is scheduled to start this year.

FOREIGN BRIEFS . . .

Exploration in southern England has been proposed by Esso Petroleum. The company wants prospecting licenses in four counties which are in the productive Paris basin. Last exploration by Esso in the U. K. was in the 30's.

A cut in petrochemical prices has been made in the U. K. by Shell Chemical and Imperial Chemical Industries. One product, propylene glycol was reduced $14 per ton, bringing the basic bulk price to $448 per ton.

A urea plant in Taiwan has been proposed by Mobil Chemical Co. and Chinese Petroleum Corp. Permission to build a plant with a capacity of 100,000 metric tons annually has been requested. Final decision on the project is subject to approval by boards of both companies and by the Nationalist Chinese Government.

Russia has completed a 186-mile crude pipeline from Ishimbai, Bashkiria, an important producing center in Second Baku, southeastward to a refinery at Orsk in Orenburg Province.

A trade protocol has been signed covering continued exports of Soviet crude and refined products to Morocco in 1961.

A third wildcat on Portuguese Timor has been spudded by Tradewinds Exploration. The well, Matai 1, is drilling in the Suai area 3 miles from the southeastern coast. Timor is 500 miles northwest of Darwin, Australia.

Posted prices for several products at Abadan refinery have been revised by BP Trading. Four grades of motor gasoline have been reduced 0.2 cent per U. S. gallon, while two grades of gas-oil and No. 2 fuel oil are up 0.2 cent. Marine diesel oil is up 5 cents to $3 per barrel.

Iran will sell 17,000 tons or about 120,000 bbl. of oil to Afghanistan under a new barter agreement. Iran will take hides and other products in payment.

A $100-million credit deal for oilfield equipment from Russia has been approved by Argentina's Chamber of Deputies. The gear will be imported by YPF, starting probably in late 1961.

Dow division uses X-TRU-COAT for a 30-mile run through swampy Louisiana soils

Dow Chemical Company's Louisiana Division selected 4½″ O.D. X-TRU-COAT (Republic's *plastic-coated* line pipe) for a service installation involving long runs through swampy soils near Plaquemine, Louisiana.

A 30-mile pipe line was needed to transfer products between Dow's Plaquemine facility and storage points. Dow specified X-TRU-COAT on the basis of corrosion-resistance, ease of installation, and overall cost comparisons.

The high density polyethylene coating of Republic X-TRU-COAT is continuously extruded over "live" undercoating to seal out electrolytic action. X-TRU-COAT is immune to ground chemicals and resists shipping, stringing, and backfilling damage.

X-TRU-COAT Plastic-Coated Line Pipe (Republic coats it at the pipe mill) is available in 1.050″ through 8.625″ O.D. You can also have the coating on Republic Light Wall—in 1″ through 4″ nominal—for gathering and distribution systems.

The complete package includes Republic X-TRU-COAT, X-TRU-TAPE Joint Wrap, and X-TRU-PRIMER. For information or quotations, call your nearest Republic representative or mail the coupon. X-TRU-COAT is produced under the Dekoron® Process.

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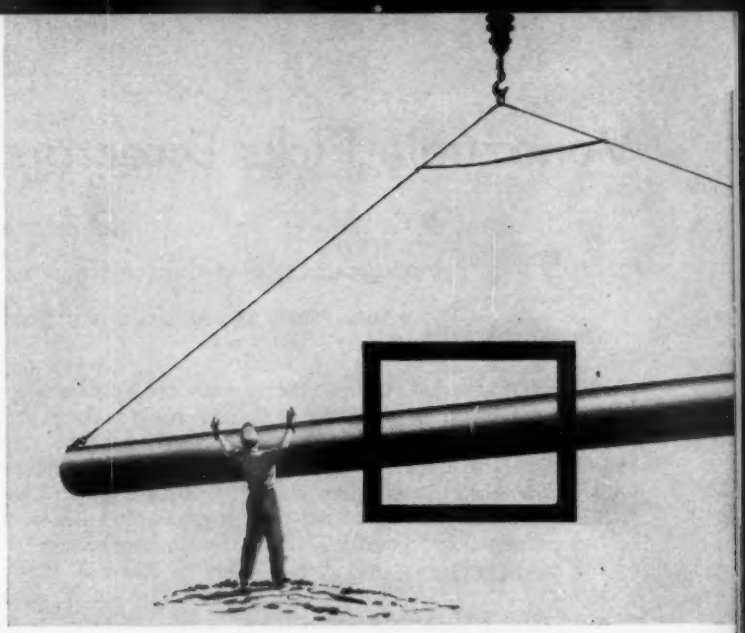

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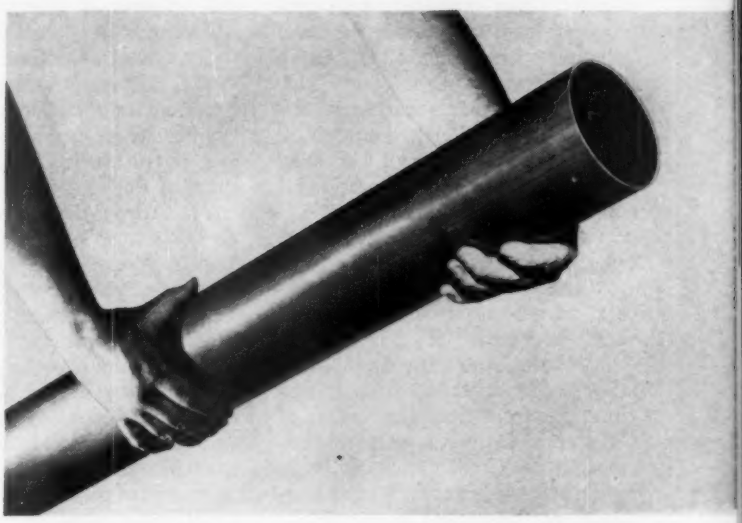

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Venezuela Picks Directors for Its Oil Firm

• Only three of the six men on the young national company's board have oil backgrounds, and they're far from being veterans. The venture isn't likely to cause many repercussions in the industry. It's mainly a government symbol.

VENEZUELA has named the long-awaited board of directors to its fledgling national oil company, but chances are it will be a long time before the slow-starting organization makes its weight known to the country's oil industry.

The six-man roster has three prominent Venezuelan oil men, two congressmen, and a businessman. Their average age is 40. The oil men have had experience with Creole Petroleum Corp., but the total "oil field" experience of the group is only 18 years.

The appointments were made by Dr. Juan Pablo Perez Alfonzo, oil minister. Perez Alfonzo will head the board until an election and will continue to play an important supervisory role in the autonomous organization.

A rundown on the board members, all graduates of Central University of Venezuela:

... **Carlos Rojas Davila,** 47, also is a 1939 graduate in petroleum engineering from the University of Oklahoma. He was a petroleum engineer with Creole from 1939 to 1952, where his specialty was conservation. He served as a consultant in the 1956-57 oil boom with Edmundo Acosta, now technical director of hydrocarbons in the Ministry of Mines and Hydrocarbons. He helped organize Petro-Servicios Consolidados, S.A., a company formed to rent marine equipment in Lake Maracaibo which never got off the ground. He also has sold bits for seismic drilling rigs.

... **Manuel Iribarren Borges,** 40, studied petroleum engineering at the University of Oklahoma in 1945. He was a petroleum engineer with Creole for 4 years, and taught oilfield physics at Central University of Venezuela from 1947 to 1949. Since 1950, he has been engaged in promoting new enterprises. One was Simpson Coal and Petroleum Corp. of Venezuela, formed in 1957 to obtain oil concessions. The company failed to get any concessions and changed its charter 2 years ago so it could make paper cups.

... **Humberto Penaloza,** 35, studied at Tulsa University in 1950-51. He is a former Creole petroleum engineer, and was professor of petroleum engineering at the University of Zulai in 1956-57. He was director of public relations for the Venezuelan Telephone Co. in 1958, and was director of economics for the Ministry of Mines from March 1959 to July 1960.

... **Godofredo Gonzales,** 39, is a lawyer and congressman. He is vice president of the Christian Socialist political party and was a Venezuelan delegate to the Arab Oil Congress at Beirut last fall.

... **Pedro Miguel Pareles,** 34, is an economist who studied at University Nacional de Mexico, University of Madrid, and the London School of Economics. A congressman, he was a delegate to the Beirut conference and to the earlier Arab oil meeting at Cairo.

... **Luis Wannoni Lander,** 46, a doctor of physical sciences and mathematics and an engineer, served as president of the Water and Sewer Institute in 1947-48. Since then, he says, he has promoted engineering and financial enterprises.

One of the first official acts of the new board was to elect a four-man executive committee which will be headed by Rojas Davila.

The other members are:

... **Jose Luis Padron** (age unknown), a geologist with the Ministry of Mines. He was employed by Mene Grande Oil Co. from 1945 to 1960.

... **Angel Felix Bravo,** 47, an accountant, is a director of another national organization, Fedepetrol. He worked in private industry from 1936 to 1946, and is a former Creole employe. He has served as a delegate to several international labor congresses.

... **J. A. Gil Yepez,** 39, a geologist and petroleum engineer, graduated from the University of Tulsa in 1948. He worked in the oil industry from 1943 to '46, joined the Ministry of Mines in 1948, and is now chief of the department of exploitation.

The national company will operate on concessions in both eastern and western Venezuela on the same basis as private foreign companies. It has an initial budget of five million bolivars, or about $1.5 million. Further financing must be obtained privately.

The first well probably will be drilled in the first half of this year on an "L" shaped 333,000-acre tract in central Lake Maracaibo known as Block 17. The area is semi-proven. Production at first probably will be sold to private oil companies.

The company has no equipment of its own, and work will be contracted at first. A certain number of foreign technicians may be employed for some posts.

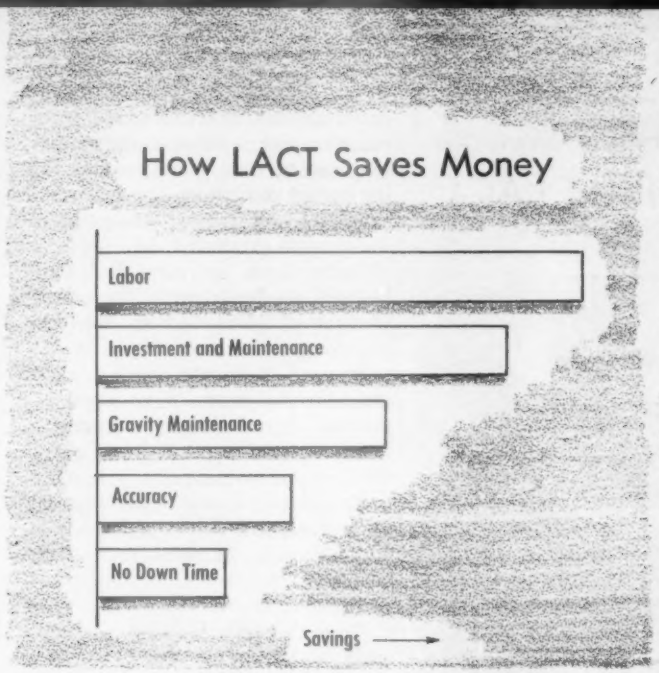
New financial program ... The national company will not be able to lean on the government for support if the new minister of finance, Dr. Tomas Enrique Carrillo Batalla, has anything to say about it.

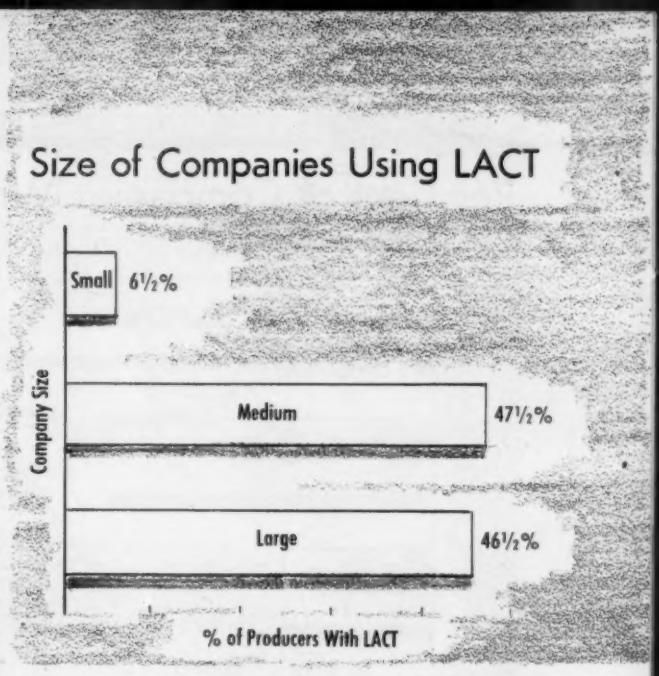
No funds for the company have been provided for in budget plans over the next 4 years and Carrillo Batalla has warned that he will not bend to pressures from governmental agencies to make exceptions.

He also has ruled that state organizations face a period of austerity and must have his written approval before undertaking any new financial programs. This apparently means he will have the last word in any capital-raising ventures planned by the government oil company.

While the company's impact on the oil industry may be small, its role as a government symbol will be important.

Its new board members will add a prestige note to such functions as the forthcoming meet of the OPEC in Caracas.





MOST OF THE MONEY saved through LACT involves decreased labor force and reduced investment in tanks and in tank maintenance. But the small operator can't afford these savings yet.

LACT- Where we've been— Where we're going— How much savings?

• Journal survey shows that biggest savings are in tanks, tank maintenance, and labor. Future looks bright as 50% of all producers are doing research of one kind or another, and so are 70% of the pipeliners.

BY W. B. BLEAKLEY
Production Editor

THE FASTEST GROWING 6-year-old in the industry is LACT. It was the fastest-growing 5-year-old last year, and the fastest-growing the year before, and so on.

There seems to be no end, short of 100% conversion.

But there are still some limitations. Not all companies can afford it now. Many leases are producing economically without it, and the operators can see no need to scrap good equipment just to modernize their operations.

Apparently the small lease can't justify the cost of LACT. At least that is the opinion expressed by several producers, although not confirmed by sources other than this survey.

And small producing companies seem to have a harder time trying to make the LACT ends meet than the majors.

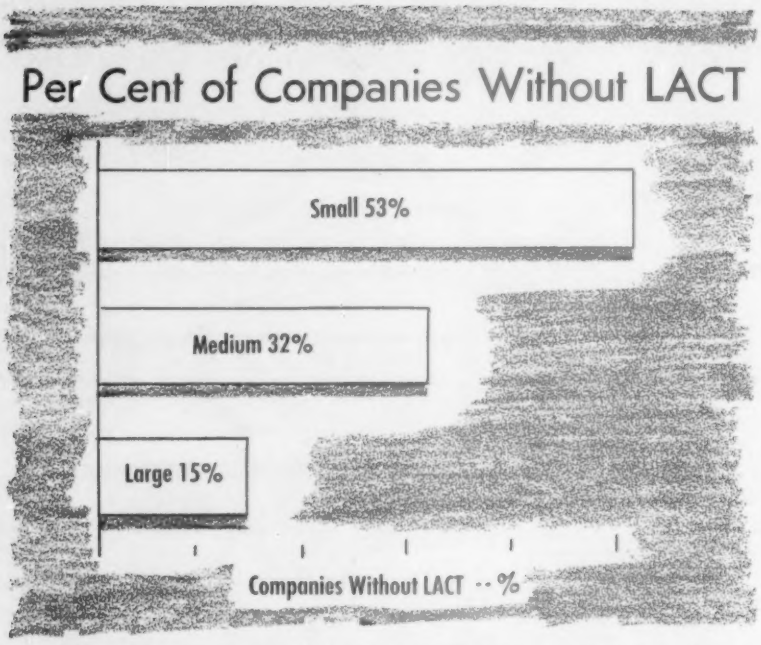
Journal survey questionnaires were sent to 265 producing companies and 18 pipeline companies. Here's what they show—for the past and for the future.

Who Can Afford It?

Our survey showed that 41% of all producing companies are now using LACT units on at least one lease. The remaining 59% have yet to purchase one, but there were several indications that the operators were ready to plunge into the automatic field soon.

There is definite correlation between the owners of LACT and the company size. Of the companies now operating the units, 93½% classified themselves as medium or large. Of the have-nots, 53% classified themselves as small producers. This shows clearly that the small company is not yet in the market for LACT.

Some of the small-to-medium-sized producers said that they were



OF THE PRODUCERS now operating without LACT, 53% classified themselves as small companies. Reasons for not buying varied, but economic justification was mentioned most often.

looking at LACT with a buyer's eye, and that they would try one soon. Others showed no interest in getting this equipment anytime in the foreseeable future. Lack of economic justification seemed to be the reason in most cases. There is no distrust of the equipment. Operators aren't worried about the things falling apart, or failing to keep track of all the leases production; they just aren't able to figure a payout!

Savings Add Up

While some operators are trying to figure out how to afford one, others are counting their savings from the LACT already installed.

Most of the savings in the operation of an automatic lease come from labor, according to 30% of all producers. They indicated this by placing a check by the "labor" box on the questionnaire. Possibly more important is the large number of "write-in" votes for savings in tank cost and tank maintenance. This was mentioned almost as many times as labor saving, and was not included on the original questionnaire as a reminder to the operator.

Gravity maintenance was mentioned enough times to win third place. Accuracy and elimination of down time also ran.

Almost all pipeline companies mentioned labor savings. This is not unexpected since there is no investment involved, and the pipelines are not responsible for maintenance. If there is any benefit to be had it would have to be in labor.

Complete or Partial Automation?

Even the simplest LACT unit is a far cry from the hand-gaging methods still in use in a lot of areas. But how far do today's operators want to go with automation?

Not far, according to our survey.

Opinion of most operators is that LACT units should be able to do their job with a minimum of instrumentation. As one operator put it, "We install all instruments necessary to sell oil in the most economical and accurate way."

Consensus was that the simpler the system was, the better it was. Obviously there is a certain amount of instrumentation required, or there would be no automation. The oil transferred from the lease to the pipeline must be metered, one way or another. And if there is too much b.s. and w. in the crude, it should be automatically returned to the treater, instead of being put into the line.

Properties of the crude and b.s. and w., are needed to figure the ticket at the end of a run, or over the period of time covered by the meter reading. This can be had from recorders, or a manual determination can be used as an average for the period of time involved.

Instrumentation needed to supply these crude properties didn't appear to bother most operators. But, they seemed to back away from any thought of going "whole hog" on accessory instrumentation and automation. Automatic well testing, strip-chart printers, data transmission to record centers all drew a pretty emphatic "no" from about 73% of the producers.

One operator said, however, that he wanted full automation on any unit that was handling more than 5,000 bbl. per day. Other comments were:

"Not currently justified economically."

"Electrician's fees too high, and he is too often needed with today's equipment."

"Periodic records are sufficient."

Pipeliners concur. Pipeliners were no more excited about full instrumentation than the producers. Two or three wanted complete automation, but about 85% were of the opinion that the minimum necessary to get the job done was enough.

Particular mention was made, however, of the need for a temperature recorder if a nontemperature-compensating meter was being used.

What Kind of Meter?

There are two principal ways oil is metered at an automatic transfer point: by a calibrated dump tank, or by a positive-displacement-type meter.

And there are differences of opinion.

But our survey showed this: Of those operators now using LACT units, 85% prefer p.d. meters, 9.5% prefer dump tanks, 5.5% are undecided. Of those operators that do not have LACT now, 16 indicated a preference anyway. It was 11 to 5 in favor of the p.d. meter.

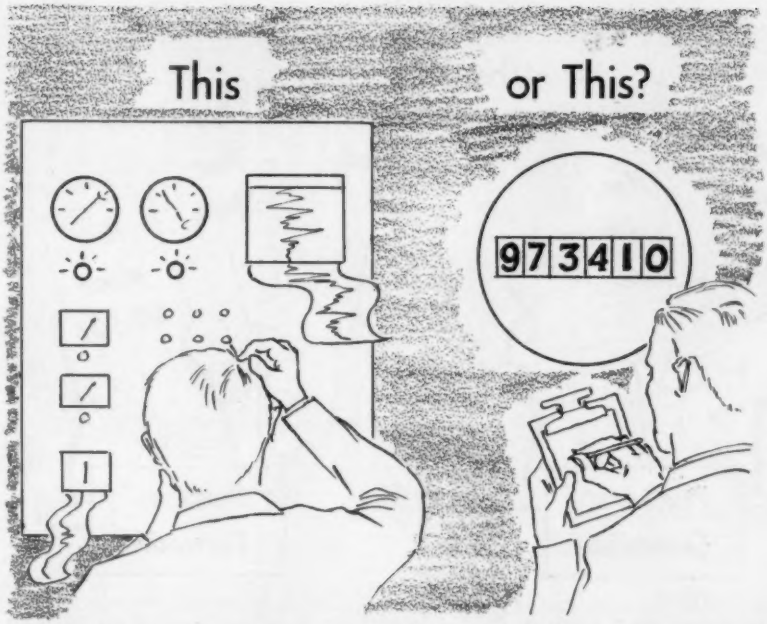
The pipeliners answered this question also, and the results were almost identical; 85% again favored the p.d. meter, 15% said either was acceptable.

In the past, objections have been raised over the use of both systems. Those favoring the dump tank say that there are no moving parts to wear out, no friction to contend

with. Those liking p.d. meters claim that a dump tank's calibration can change with a small deposit of paraffin. And so it goes, but the results of this survey seem to prove conclusively that the p.d. meter is here to stay.

One of the more surprising results of the survey is the interest shown in research on LACT systems. At least half of the companies now operating automatic units are involved in some sort of research work. In many cases the response showed that the work was of a pretty informal nature, more or less field experimentation with installed equipment rather than basic laboratory-type research. As one operator put it, "We are trying to simplify the design to reduce cost."

The pipeliners are at it too. Their responses showed that 70% of them were including LACT research in their budgets.



SIMPLE BUT ADEQUATE instrumentation is preferred by most operators instead of completely automated printout machines. There seems to be no enthusiasm for data transmission to record centers.

Stock Item or Custom Built?

Decision to make a survey on LACT came as a result of a trip to a steel fabricating plant early in 1960. The plant manager was showing us the automatic units that were being assembled on the shop floor. There were three of them, and they were as different as night and day.

These units were being built for three different producing companies. They had about the same capacity, and would all do the same job—transfer oil from the producer to the pipeline company and keep some sort of a record of the amount sold.

"Mack," I asked, (that isn't his name), "isn't this pretty expensive, making these units by hand this way?"

"Sure is," he said. "And that isn't all. This unit here (pointing to one of them) has the same built-in mistakes that we made for Company A on its first one. It learned the hard way that this gadget (touching a piece of equipment) should be put around on the other side. We tried to pass this on to Company B, but this is the way they had it in their specs, so this is the way we built it."

"Funny thing," he went on, "the producers seem to be traveling along parallel paths. They each make the same mistakes at about the same point in the development of a unit like this. We would like to settle on a standard design, go into assembly-line production and save some money for the operators, but no one seems to know what a 'standard' unit would include."

This question was pursued further through letters to most LACT-unit manufacturers.

They were asked if they had a stock model of an LACT unit—an off-the-shelf item that could be delivered to a lease and installed without meeting with the producer to decide whether to put the b.s. and w. monitor upstream or downstream of that 2-in. elbow.

Two or three firms indicated that this could be done, and that they were ready to deliver the unit the next day, if necessary. But most of them were more reserved in their comments. Yes, a unit could be delivered in 3 weeks or so, but the producer and the manufacturer would have to get together first and decide what brand of pump was to be used, what make of meter would be installed, and so on. It seemed to boil down to this; the units that the manufacturers had to offer were stock units up to a point, and then they were customized to suit the individual producer's choice.

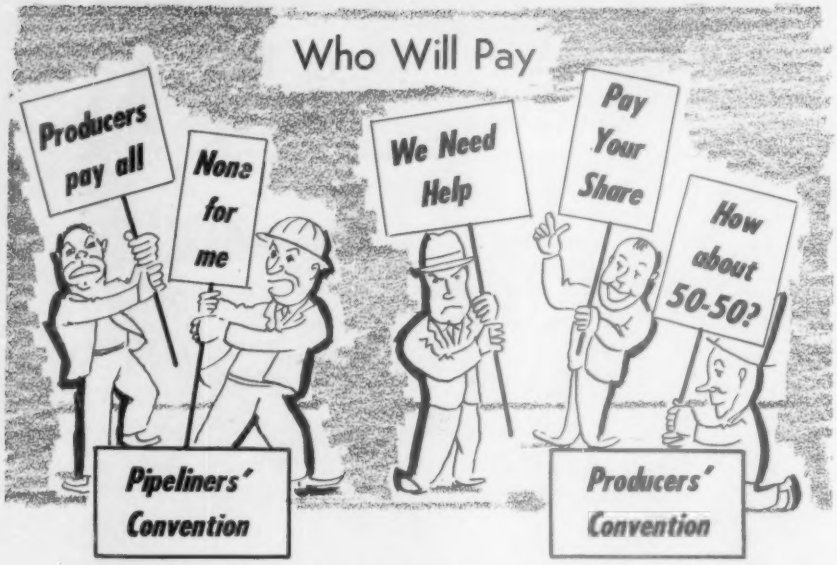
The only thing stock about most of the units, then, is the outside shell and the nameplate.

Who's fault is it? The manufacturers are not to blame for this costly way of doing business. They can't afford to make final assembly on a stock unit if it won't sell as is. A producer may like all its features except one or two, and will buy if these are changed. The stock unit might have been assembled with an XYZ bad-oil transfer pump driven by an ABC electric motor. But the operator wants an ABC pump and an XYZ motor. Making these changes delays delivery, and increases the cost, so the manufacturer can often start from scratch on a unit, build it completely to the customer's specs, and still meet the delivery deadline. There is not much incentive to the manufacturer to keep a stock of units on hand.

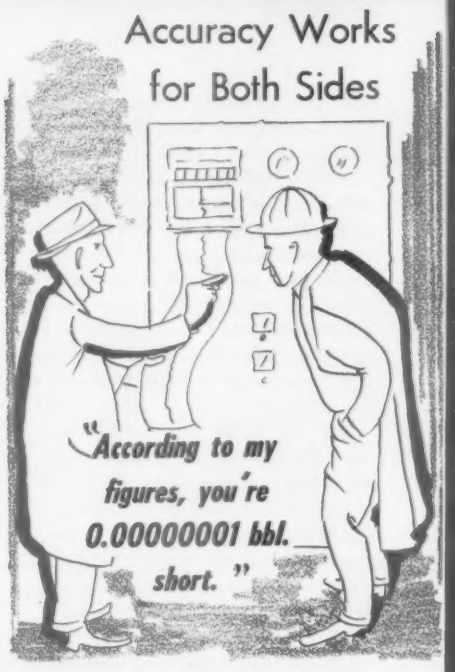
The production people are not wholly to blame, either. They may insist on an XYZ motor or pump because their experience with this brand has been good, while all of the ABC equipment has given them nothing but trouble.

But there is probably a middle to this road to confusion. It is understood that there is an API committee actively working on this problem, and it would be to the advantage of all concerned if manufacturers and producers alike would cooperate with this committee to the fullest extent.

Our survey showed that there was



NO RELIEF is in sight for the producer as far as cost is concerned. Although pipeline companies report a savings in labor through use of automation, they are reluctant to share the burden of cost.



DIFFERENT OPINIONS about the degree of accuracy expected from LACT will probably be ironed out by API.

some producer interest in the limited number of stock units that are available. Most operators showed that they were using both the stock items and the custom-built units. Only 16% had experience with the stock units alone.

Of more significance, perhaps, is the operators' expressions of future needs.

This showed that 56% of all producers planned to buy stock units for their upcoming automation programs.

Of the operators not now using LACT, 84½% had no opinion on this point, 11% favored the stock unit, and 4½% favored the custom-built unit.

It can be safely assumed that these opinions could be easily changed, depending on availability of the desired unit. If there is no stock-unit production, there will be no stock-unit sales.

Those operators leaning heavily to custom-built LACT gave various reasons for doing so:

"Variations in pipeline requirements such as meter-failure safety devices, temperature-limit controls, air eliminators, and daily set-stop counters preclude purchase of stock units."

"We prefer our own design because it costs less."

"We will use custom-built units for uniformity."

"Most stock units are limited to one brand of components, and are complicated by too many safeguard devices."

"Custom units allow choice of equipment to design for low initial cost."

Who Pays for It?

Like two oil men trying to outshuffle each other for the luncheon check, the producer and the pipeliner are still at odds as to the responsibility for the cost of LACT units.

Most producers feel that the pipeline company should bear some of the cost since the unit is of mutual benefit. Most of the pipeline people feel that the producer should pay for all of the equipment.

Some operators stated that the pipeline company paid for their prover, and in other cases, the pipeline company paid for the meter.

Canadian operators seem to have a better time of it than those in the U. S. In one case, the pipeline company paid 50% of the cost of the entire installation, and in another case about 25%. From sources other than survey we learned that some Canadian producers pay for equipment only to the surge-tank discharge valve.

Only one pipeline company showed a willingness to share the cost, with no basis being specified. Two others felt that they should pay for the sampling device.

So far this looks like a one-way street. Perhaps the reluctance on the part of some operators to install LACT is based on this disagreement between the parties that stand to gain by automation.

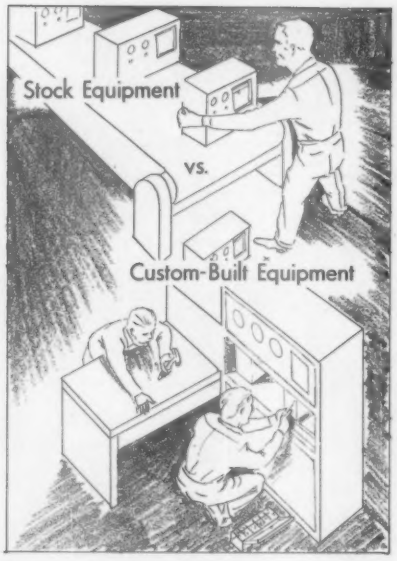
What Size Unit?

Producing companies were asked to indicate the size of unit that their future operations would require most. Choice was to be made in 1, 2, 3, etc. order, with No. 1 representing the greatest need, No. 2 the next and so on.

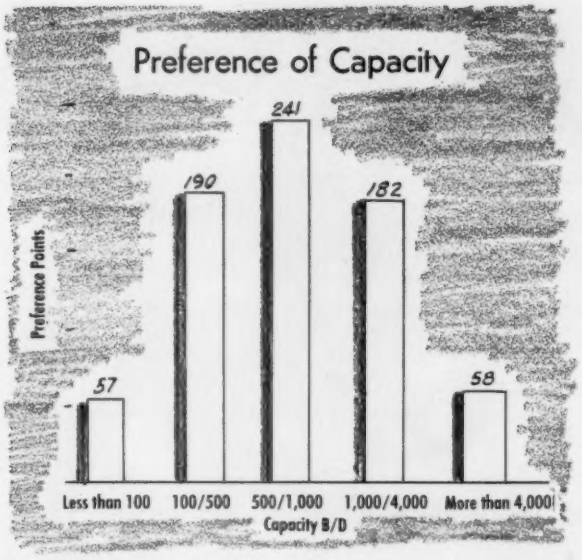
By reversing the order, and using the number as a multiplier, a weighted number of points was assigned to the unit sizes specified in the questionnaire. Results show that the greatest demand, with 241 points, will be for units within the capacity range of 500-1,000 bbl. per day. There was practically a tie for the second-place spot, with the 100-500-bbl. per day units getting 190 points, and 1,000-4,000-bbl. per day unit getting 182 points.

Units with capacities less than 100 and more than 4,000 bbl. per day didn't show up too well. Again there was almost a tie, with the results showing 57 and 58 points respectively.

There seemed to be no correlation between company size and the size of the units needed for future operations. As many medium-sized companies, for example, gave first



LACT units may never become off-the-shelf items unless producers and pipeliners alike get together on specifications, design, and degree of accuracy.



MOST PRODUCERS indicated that their future demands for LACT units would be for leases in the 100 to 4,000-bbl. per day class. At less than 100 bbl. per day the payout doesn't look good, and not many leases make more than 4,000 bbl. per day

place votes to the 1,000-4,000-bbl. units as did large companies.

Had Any Trouble?

Most new equipment designs contain a lot of "bugs" that must be corrected before future models become trouble-free.

LACT is no exception, but producers had a surprisingly small number of complaints about the equipment already in operation.

Biggest trouble spots were samplers and b.s. and w. monitors. Temperature compensation on meters and electrical troubles were also mentioned, but less frequently.

Most of the sampler and monitor trouble seems to come from the crude itself. Paraffin deposition was blamed in most cases, with other comtainants, like iron sulfide, getting some mention also.

Difficulty has usually been cleared up by plastic coating, heating, installation of protective screens, etc.

Apparent lack of real trouble seems to be a noteworthy record for new equipment items of such a complex nature.

From the pipeline side of the picture came reports of trouble with temperature compensators. One response showed so much trouble, in fact, that the compensators were removed and a temperature recorder was installed. Others mentioned foreign material as a source of trouble, and there were complaints about the b.s. and w. monitors.

How Accurate?

Producers and pipeliners alike were asked to express an opinion on the degree of accuracy that should be expected from LACT, and what would be fair to both parties.

Responses here ranged from a low of 0.01% to a high of 1.0%. Most answers were around 0.1%. Some said that the accuracy should be equal to or better than that obtainable by hand-gaging methods.

It is generally agreed that a tank can be gaged to within ±⅛ in.[1] In an 80,000-bbl. tank this is equivalent to 0.03% when the tank contains 65,000 bbl., and 0.12% when the tank contains only 15,000 bbl.

The majority of the responses to our questionnaire were in the right ballpark—around 0.1%, and there should be no real trouble in reaching an agreement on a standard, and no trouble in finding equipment to get the agreed level of accuracy.

What's Your Opinion?

We asked both the producers and the pipeliners to make any general comments about the LACT business that they felt appropriate. Here are some of them: From the home office of a small producing company—"Have investigated LACT but considered it unnecessary due to a surplus of tanks."

From another small producer—"We feel the cost is hard to justify for a company our size. Where one pumper can handle several leases we can't afford to hire electricians to take over the pumper's job."

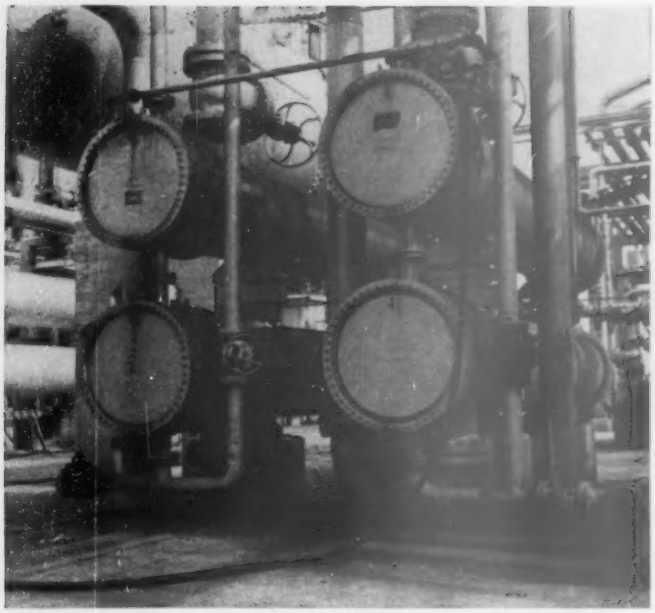
A suggestion from a small producing company's home office—"We find pipelines as eager as we are to have LACT units, but their policies vary so widely it takes too much paper work and discussion to get one approved. A meeting of chief gagers of major pipelines might help them settle on a policy as to what they could furnish. We feel the API should standardize and approve components."

Home office of a large producing company—"In order to use LACT on small batteries it will be necessary for the pipelines to bear a share of the cost in proportion to the benefits they derive."

Home office of a large pipeline company. "We have found that the dump-tank-type LACT unit requires improvement in reliability, accuracy, and cost to compare with p.d.-meters."

References

1. Peterson, C. L. and Wagner, E. F., "How Accurate Is Hand Gaging?": Symposium on Bulk Quantity Measurement, ASTM Special Technical Publication No. 249.



AFTER THE HOSE has been hooked up . . .

ABRASIVE FLINT is poured into sandblast machine.

Sand slurry scours condensers at

Simple, inexpensive technique cleans tubes while exchanger is on stream

BY KENNETH BROOKS
District Editor

IT HASN'T BEEN necessary to go inside a condenser to clean the tubes in over 5 years at the Hartford, Ill., refinery of Sinclair Refining Co.

The reason is an ingenious but simple method of cleaning the tubes while the exchanger is on stream. Sinclair engineers call it sand-slurry cleaning. The slurry is a mixture of air, sand, and water which is blasted through the tubes.

During a turnaround, when time and men are at a premium, the condensers never have to be cleaned.

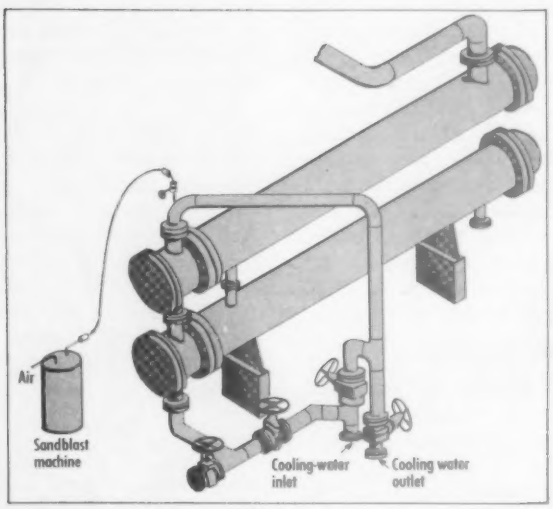
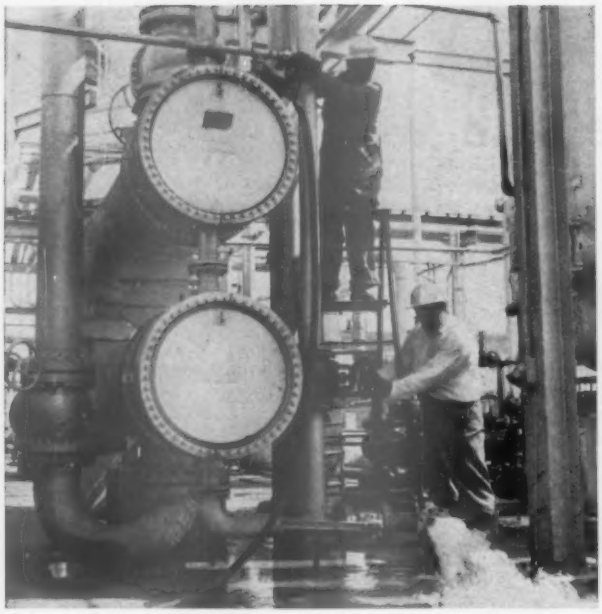


DIAGRAM OF CONDENSERS shows typical arrangement for sand-slurry cleaning.

How it works. A diagram of a typical condenser system is shown in sketch. Cooling water normally enters the bottom exchanger, circulates through the tubes, and discharges through the line marked cooling-water outlet.

During cleaning, cooling-water flow is reversed. Sinclair has found that this does a better job and it helps to keep sand from settling in the system.

During the cleaning procedure all valves are kept wide open so that normal flow is maintained. Cooling water enters a typical exchanger at about 35 psig.



WHEN COOLING-WATER flow has been reversed, air and sand are blasted into the system.

SAND SLURRY is exhausted to a drainage ditch. Whole operation takes about 15 minutes for a large exchanger.

Sinclair's Hartford, Ill., refinery

When the valves have been set and cooling-water flow has been reversed, air and sand under about 100 psig. are blasted into the system. After passing through the exchangers, the slurry is exhausted into a drainage ditch.

It takes only about 15 minutes to clean a large exchanger. About 2 cu. ft. of sand is used. For a small exchanger, cleaning time is cut to about 5 minutes.

Key to successful use of the technique is to do it often and to do it before the scale becomes too hard and too thick to sandblast effectively.

Sinclair's timetable calls for condensers to be cleaned about every 3 months, or whenever the temperature difference between the tube-side and shell-side fluids has reached a critical point.

For instance, one of the exchangers on the fluid cat cracking unit has a normal mean temperature difference of 17° F. When this temperature difference gets up to between 25° or 30° F., showing that enough scale has accumulated, the sandblasting crew is called in.

Since the technique will work only if the scale is relatively soft, the exchanger heads should never be removed. Exposure to air will dry out the scale rapidly. Then the only solution is to ream out the tubes.

Sand used to make up the slurry is an abrasive flint which is mined locally. However, other things can be used too. One Sinclair plant uses a finely divided anthracite coal.

Wear and tear on the tubes is minor. To check the effect, about 100 bags of sand were blasted through a test condenser. There was no appreciable wear. Since it would take many years of cleaning to use this much sand, there is no danger of damage to the tubes.

Sinclair engineers describe the deposits found in the condenser tubes as mostly dead algae. Chlorine is slug fed to the cooling-water system once a day to kill the algae, and it settles out in the exchangers around places where the flow is not great enough to maintain it in suspension.

This is one of the reasons for reversing cooling-water flow. It can get underneath the clinging algae and help to "pull it out by the roots." The abrasive action of the sand finishes the job.

All of the refinery's water comes from wells. Since water is at a premium, it's recirculated many times. It is relatively clean, containing some iron and a small amount of turbidity. There's just enough blowdown to keep suspended solids from accumulating in the system. Table 1 shows a detailed cooling-tower-water analysis.

In addition to chlorine injection once a day, the water is treated with phosphates and it's pH-controlled at 6.0 to 6.5 pH.

TABLE 1—TYPICAL COOLING-TOWER WATER ANALYSIS

	P.p.m.
Total dissolved solids	1,040
Suspended solids	50
Total hardness (as $CaCO_3$)	560
Calcium hardness (as $CaCO_3$)	380
Magnesium hardness (as $CaCO_3$)	180
Phenolpthalein alkalinity (as $CaCO_3$)	0
Total alkalinity (as $CaCO_3$)	10
Phenolpthalein acidity (as $CaCO_3$)	10
Chlorides (as NaCl)	52
Sulfate (as Na_2SO_4)	938
Ortho phosphate (as PO_4)	21
Total phosphate (as PO_4)	22
Silica (as SiO_2)	53
Total iron (as Fe)	8.7
pH	6.3

"All that the authors attempt to indicate in this article is that . . . **There are still ways to combat high corrosion-control costs** . . . by thorough planning, careful construction, continuous monitoring"

BY THOMAS J. J. DEGNAN AND N. K. SENATOROFF
Pacific Lighting Gas Supply Co.
Los Angeles

THE IMPORTANCE of corrosion-control costs in pipeline work is difficult to overstate. Here we have an extremely simple yet very costly investment. There are only a few moving parts and a minimum of control problems. Yet the investment may dwarf that of some very complex processing plants with a great variety of corrosion-control problems.

The key to successful pipeline-corrosion control is to recognize the task. It is to control corrosion at minimum cost since the difficulties are caused mainly by size, not by their nature.

Cost reduction. Reduction of the total cost implies a proper balance of initial costs and all future costs. Initial costs include the cost of pipe, coating, and cathodic protection. These items are more readily estimates and, unfortunately, are generally given undue weight. Future costs include maintenance, repair, and operation. The steady rise in prices, particularly labor and equipment, multiplies the importance of elements which must be paid for with tomorrow's dollars.

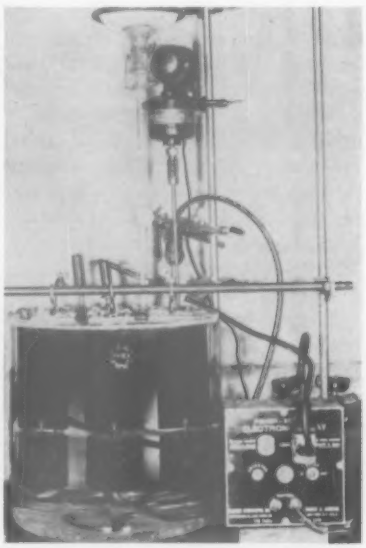
The cost of service interruption and repair due to a serious break must include the damage to public relations and to the owner's legal status. This damage was all but unrecognized until recent years, largely because it is not as easily evaluated nor of as immediate interest as initial cost components. But, while somewhat intangible, it is nonetheless real.

The reduction of cost therefore does not rule out considerations of quality and it must be based on these three steps: Thorough planning, careful construction, and continuous monitoring of operation.

Paper presented at NACE meeting, Tulsa.

These steps may be studied in an examination of: (1) Control of environment, (2) cathodic protection, and (3) pipe coating.

Soil variations. Environment is subject to little direct control. Even the most complete survey, including a study of soil resistivity along the entire route, seldom results in locating the pipeline far from the most direct route. A soil-resistivity survey is usually a single sample taken at one particular time of the year. Variation of resistivity is as indicative of corrosivity as the level of resistivity. However, a wide variety of soil types can be met with a choice of more than one coating for the different locations along the pipeline. In any case, a study of the environment should be made early in the planning stage.



TEST APPARATUS for determining deformation characteristics of pipeline coating enamel. Fig. 1.

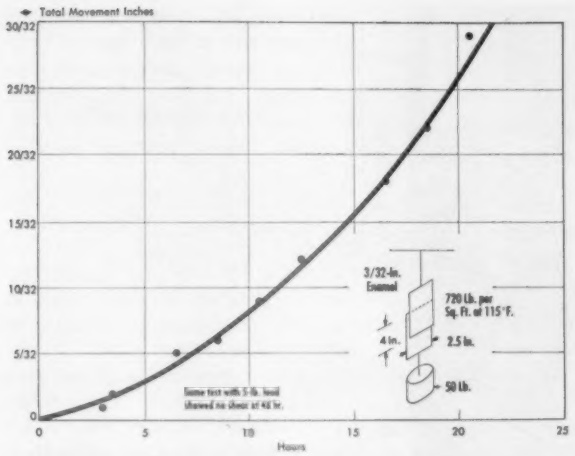
The most cursory survey, even by air, will reveal the need of special attention to particular locations. A section of pipeline running through a congested area may require galvanic anodes in preference to large-unit, impressed current protection to avoid electrolytic damage to the buried property of others. Rocky environment influences backfilling operations and may require shielding of the coating with an outer wrapper.

The most common means of coping with a particularly bad environment is not by changing the environment, but by interposing another environment. This is what is done by coating, casing, or manifolding the pipeline.

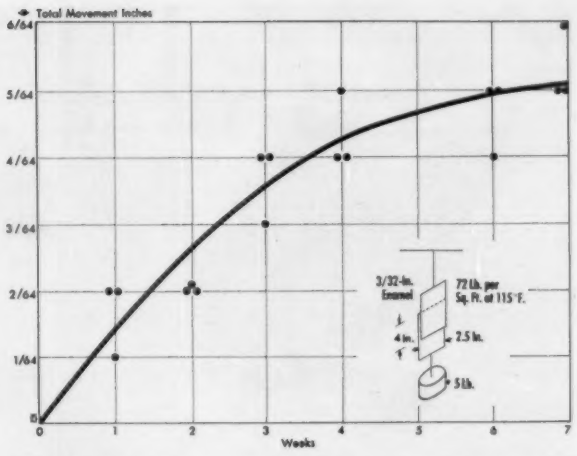
Twin-line crossing. To illustrate, that part of the Desert pipeline laid under the Colorado River consists of two 24-in. lines in parallel instead of a single 34-in. line. The soil here is of low resistivity and accessibility for repair is impaired. Therefore, these two lines were given double-thickness coatings. Weighting was done with a 2-in.-thick, wire-reinforced brush coat of concrete. This gave a measure of protection from mechanical damage.

Another example of avoidance is casings at highway and railroad crossings. Besides isolation from corrosive soil, casings protect the pipeline from superimposed loads, help to avoid danger in the event of a leak by venting it at a safe distance, and provide accessibility for repair.

High-pressure pipelines, with considerable variation in both gas and ground temperatures, are subject to a particular hazard. That is movement of the pipeline which



DEFORMATION TESTS show that degree is affected more by size of load than by length of time. Fig. 2.



HALVED LOAD deforms at rate 33.3 times slower than full load. Fig. 3.

causes secondary stresses and destruction of the coating by rocks. Most of the movement is concentrated at overbends.

Cooling eliminated. The Desert pipeline was designed to operate at 1,032 psig. from 50° to 135° F. The high cost of properly treated water for cooling compressor discharge and other considerations dictated elimination of cooling. This resulted in the higher of the two temperatures.

Side bends were limited to ½° per lineal foot; no special restriction was placed on sag bends, but anchors were required on overbends unless the cover was at least 30 in. and the bend radius at least 1,020 ft. Telltale markers were installed in vaults to measure line movement and strain gages were cemented to the pipe at the most critical bends. These were small-radius bends downstream of the compressor station. These indicators will be monitored during operation of the pipeline and correlated with temperature and pressure.

Product controls. Internal environment of the pipeline is more readily subject to direct control. Gas-purification plants may be installed or product quality can be specified in the gas-purchase contract. Highly restrictive requirements increase the product cost out of proportion to the reduction in damage from corrosion.

The following maximums are ordinarily not unreasonable to specify: oxygen, 0.2%; water vapor, 7 lb. per M.M.c.f.d.; liquids, none at delivery pressure and temperature; hydrogen sulfide, 0.25 grains per 100 std. cu. ft.; organic sulfur (excepting mercaptans), 0.5 grains per 100 std. cu. ft.; carbon dioxide, 3 vol. %, and nitrogen and carbon dioxide, 4 vol. %.

The gas is continuously sampled and checked by the purchaser at the point of delivery and by the supplier at the point of origin with a free flow of information in both directions.

Cathodic Protection

Pipeline-corrosion control must include both external coating and complementing cathodic protection. Use of extra wall thickness is wasteful, expensive, and not particularly effective. The cost of power alone prevents economical protection of uncoated transmission lines. Protection with coating alone, without electrical drainage, demands perfection of the coating which is unrealistic.

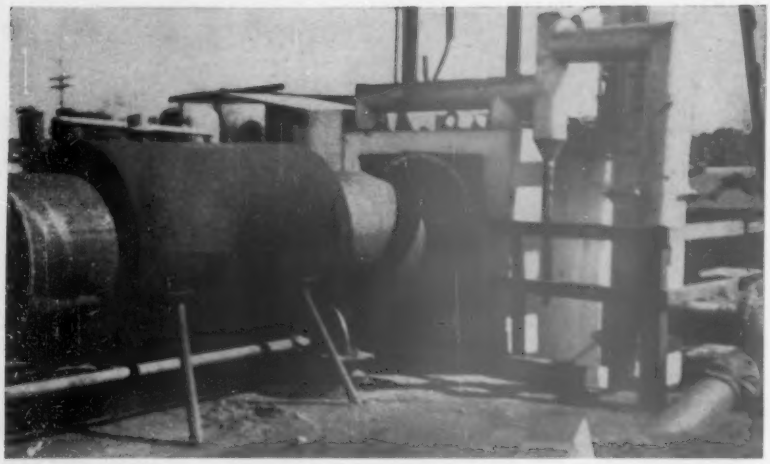
Striking an economic balance between coating and cathodic protection is not easy. Some error is inherent in calculating the economic balance between coating and cathodic protection. It is only prudent to make sure that the coating is a little better than absolutely required. Adding rectifiers toward the end of the pipeline's life is better than coating reconditioning or repeated leak repair and outage at that time.

High-strength steel. Perhaps the most significant savings in building high-pressure pipelines are the result of higher-strength steels. However, attendant decrease in ductility increases the hazard of stress concentration at such points as nicks, gouges, arc burns, and electrolysis pits. Credit for these most significant savings can be shared by the development of cathodic-protection techniques and more effective inspection practices.

Monitoring of operation is a necessity with cathodic protection. Besides the gradual deterioration of coating materials over the years, other changes complicate the task. New pipelines create electrolytic interference problems. The soil, brought under cultivation by irrigation and chemical treatment, has its corrosivity increased. It is mandatory to inspect rectifier operations and the level of pipe potential at critical locations monthly. It is advisable to completely resurvey the cathodic protection every 2 or 3 years.

Cathodic protection must be part of each step in planning, construction, and operation of major transmission lines. Attention to detail is essential where electrical work is concerned. One small detail can be the difference between perfection and utter failure. A few details that do not always receive sufficient attention are worthy of mention.

Trouble spots. Casings under railroads and highways are potential sources of trouble because of the possibility of shorting the pipeline's cathodic protection to ground. Insulating spacers were placed at 10 ft.



DOUBLE JOINTING on Desert pipeline. Production-line techniques were used to cut labor cost. Fig. 4.

or less along the 40-in. casing, except at the casing ends, where 2-ft. spacing was used. The difficulty of obtaining a straight bore and the expenses incurred by shorted protection justified the small additional cost.

A tough, abrasion-resistant coating is needed for bored casings. Desert pipeline casings were shop-coated with 1/32 in. of filled epoxy-resin material. It contained 100% inert solids and no solvents. The coating required at least 12 hours' curing time at 70° F. Therefore, a double wrap of polyethylene tape was applied over primed pipe at field joints to speed construction. With coating applied, cathodic protection of the casing was then possible with either a minor amount of impressed current drainage or with magnesium anodes.

The casing insulators, as well as all insulating joints, were tested electrically during construction while repairs could be made without exorbitant cost.

Test lead wires. Test lead wires are installed to measure the pipe potential after backfilling. Popular practice has been to space them at 2,000 ft. along the entire line. At a cost of nearly $60 each, this practice seems unwarranted. Many test leads may be installed that are almost inaccessible or unneeded, while some that are necessary are omitted.

A more reasonable plan is to install test leads at the following places: (1) at the midpoint between block valves; (2) at each casing, one test lead on the pipe and one on the casing; (3) at every buried insulating joint, one test lead on each side; and (4) at each buried steel structure crossed and at each foreign anode bed near the pipeline, three test leads spaced at 2,000 ft., to permit measurement of pipeline current.

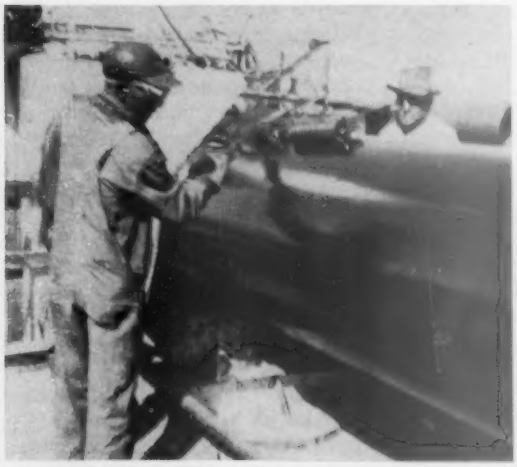
It is advisable, even with this detail, to provide for modification by the owner's inspector. Otherwise, the test leads will be installed at exactly specified locations without regard to access roads or close to appurtenances which serve as contacts to the pipeline, such as vent valves or drip lines. Without understanding of the purpose of test leads, possibilities of misapplication are limitless.

Divided sections. Insulating joints divide the pipeline into sections for convenient analysis and protective treatment. They also isolate the pipeline from grounding at such structures as bridges, meter stations and compressor stations.

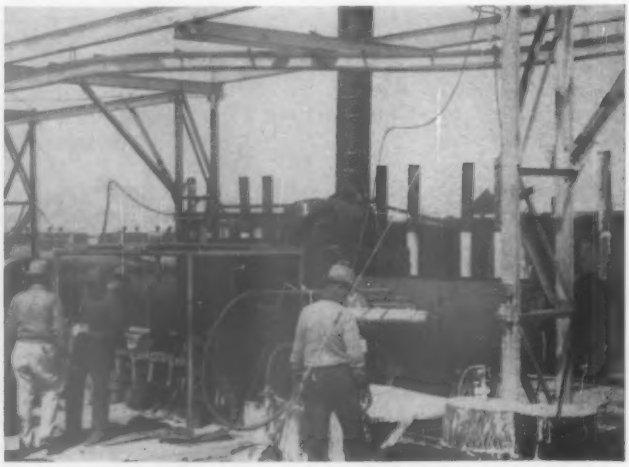
The 24-in. lines under the Colorado River were isolated electrically from the rest of the pipeline. This section was laid in much lower-resistivity soil, was less than 1,400 ft. long, and had been given double-thickness coating protected by 2 in. of concrete. The current drainage demand was naturally small, but early protection was imperative. Therefore, two magnesium anodes were buried in the river bed during construction and protection was afforded immediately.

Pipe Coatings

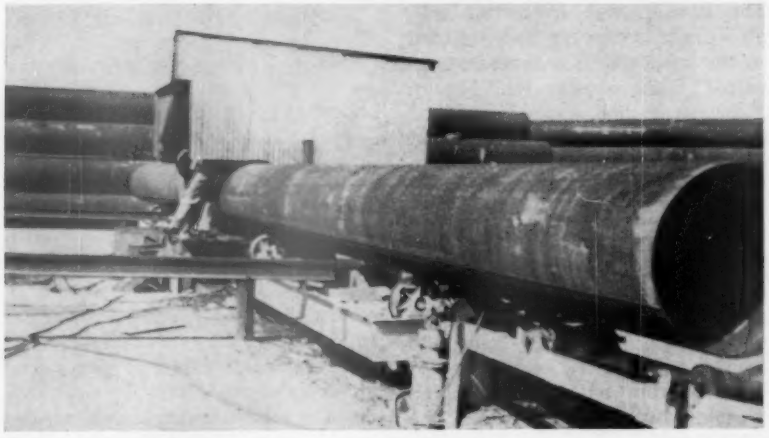
In designing a new pipeline, engi-



PRIMING OF PIPE followed grit blasting. Primed joints were dried and "cured" before coating. Fig. 5.



ENAMELING AND WRAPPING with asbestos felt are part of production-line technique. Fig. 6.



PREHEATING FURNACE helps loosen mill scale and evaporates surface moisture before grit blasting. Fig. 7.

neering personnel are so burdened with a variety of construction matters that any portion that does not actively demand attention is quite likely to be deferred. Provision for a corrosion-control program all too often fails in this category. This deferment may cost many thousands of dollars more for control than identical installations would have cost if they were considered in the planning stage and carried out at the time of construction.

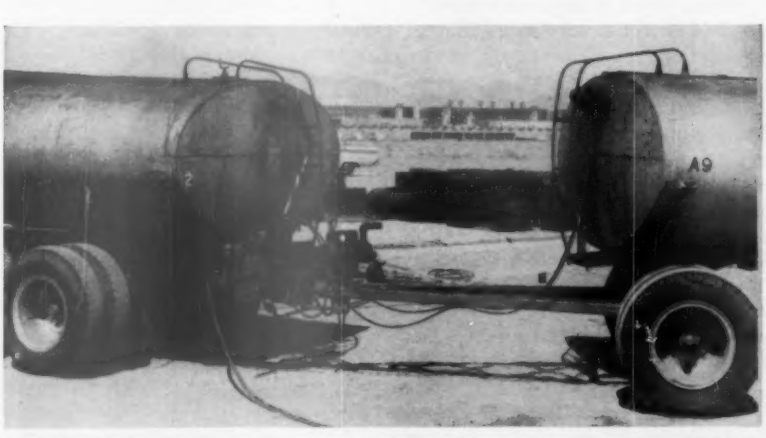
At the outset of the project, it appeared that considerable operating advantages would result by designing to operate at a temperature of some 135° F. It would eliminate conventional water-cooling towers and the difficulty and expense of their operation. The decision was made to design this line to operate "hot."

Different coating. A second decision—a submerged crossing of the Colorado River—resulted in recommending an entirely different type of protective coating. In addition to corrosion resistance, it would also control the buoyancy of the pipes. When coating weight was added to the weight of the pipe, the total weight per foot would be at least 360 lb.

Both coating specifications were approved only after design engineering was assured that each coating, in addition to the specific performances expected of it, would also protect the pipe against corrosion for the life of the line.

Application of economics to the problems of corrosion control is an important factor in drawing up specifications. It necessitated a review of the methods of control, of the material, and of the techniques of coating applications.

One of our first steps in drawing up the specifications was material selection.



BULK DELIVERIES of hot enamel saved minimum of 10% in cost of coating application. Fig. 8.

New enamels. In the past decade new coating enamels with higher melting points have been introduced. In combination with reinforcing materials of the glass inner wrap and the asbestos-felt outer wrap, laminated coating structures were designed to withstand extreme temperature fluctuations and the forces of deformation exerted by the soil and pipe stresses.

Pacific Lighting Gas Supply Co.'s laboratory found that, for severe conditions, the best resistance to deformation would be obtained with a coating incorporating plasticized, high-melt coal-tar enamel in its laminated, glass-and-asbestos-reinforced structure. Considering the fact that the pipeline-laying specifications would require grading the trench so that the pipe would have a uniform bearing on the bottom, it was assumed that the probable bearing pressure on the coating would not exceed 0.5 psi. It was also estimated that the bearing pressure of the backfill on the top quarter of the pipe would not exceed 0.25 psi.

Because the line required coating which would withstand the effects of 135° F. pipe temperature, a shear or a deformation test was suggested. It was designed to get some data on the "rate" of deformation experienced by the 3/32-in. layer of unreinforced plasticized enamel at 115° F., the maximum recorded ground temperature along the right-of-way.

Tests required. The stress-deformation tests were dictated by the uncommon operating conditions and the wide range of primary and secondary stresses. These were caused by ground temperatures varying between 50° F. in the winter, when line is "packed," and 135° F. in the summer, when line is "drafted," at "capacity flow." It was calculated that the pipe would be subjected to a longitudinal loading of 990,000 lb. Inclusion of long-radius bends to enable the line to behave as a column excluded the possibility of axial load transmission through the coating to the soil. Nonetheless, seasonal variations of ground temperature had to be considered as factors affecting resistance of the coating to deformation.

The deformation test used three pairs of light-gage 2.5 by 4.0-in.

steel coupons, blasted, primed, and sandwich-coated with a 3/32-in. layer of enamel. They were prepared the same as a coating application in the pipe yard.

The coupons were continuously submerged in water and maintained at 115° F. ±0.5° F. They were loaded with lead weights of 5 and 50 lb. attached to one of the coupons of each pair, Fig. 1.

Size, time factors. For a given enamel specification, the degree of deformation depends on the size of the load and length of time. Loading has the dominant effect, Fig. 2.

For example, a specimen under a halved loading deformed at the rate 33.3 times slower than at the full load. To attain a deformation of 6/64 in. under 72-lb per sq.-ft. load in 6 weeks, as shown in Fig. 3, it will require 33.3 times 6 weeks or approximately 4 years if the load on the coating is reduced from 72 lb. per sq. ft. to 0.25 psi.

Since the test was conducted on enamel unreinforced with inner glass and outer asbestos wrappers, the results provided the most conservative information on the rate of enamel deformation under extreme service conditions.

Test results. This investigation also demonstrated that the plasticized coal-tar bitumastic high-melt enamel could withstand normal shearing strain due to soil even at 115° F. without the apparent permanent damaging effect as long as the strain was not protracted indefinitely. It also strengthened our conviction that the enamel reinforced with wrappers would have even greater endurance to deformation under the shearing strain not exceeding 0.25 psi.

Production-line techniques and near full automatic operation were used to raise productivity at both Minneola, Calif., and Henderson, Nev., railhead storage yards. Reduced labor costs and rigid quality control were major achievements.

The 305,000 ft. of 34-in. pipe allocated for each yard was handled identically. After double-jointing (Fig. 4) into 80-ft. lengths, the pipe was grit-blasted, primed with coal-tar 70-B primer, dried, and coated with a minimum 3/32-in. to an average 4/32-in. thickness Bitumastic Hi-Melt coal-tar enamel, Fig. 5. The coating was reinforced with glass inner wrapping and shielded on the outside with coal-tar-impregnated 15-lb. asbestos felt, Fig. 6. The coated pipe was whitewashed to lower its temperature on hot, sunny summer days from 120° to 90° F.

Joints preheated. The cleaning was preceded by slight preheating, Fig. 7. Each joint passed through a gas-fired heater on its way to the grit blaster. The heat helped to loosen mill scale and evaporate surface moisture from the pipe and thus improve the efficiency of the grit blaster.

The priming operation immediately followed the grit blaster. Pipe joints finally ended on the laydowns for drying. After "curing," primed joints were fed into a coating-and-wrapping machine by a conveyor system.

Coated and wrapped pipe was whitewashed while still hot. After cooling and drying, the pipe was tested for defects with a holiday detector. The pipe was then either stockpiled or loaded for shipment.

In tailoring the coating specification to fit the uncommon features of the pipeline, conventional methods of coating-material handling were reviewed. The thought was to gain some savings in the cost of at least one high-priced item: the recommended plasticized enamel.

Savings shown. Studies indicated that bulk deliveries of molten enamel would result in substantial savings in the cost of enamel and labor costs of the contractor for handling drum-packaged enamel, Fig. 8.

Enamel cost savings amounted to about 2¾ cents per linear foot of application.

Still greater savings were realized from the manpower requirements for handling drum vs. bulk deliveries.

The normal 5 man-days to break up drummed tonnage to keep up with a yard production of 8,000 to 9,000 ft. per day were reduced to 1 man-day. These savings further reduced the cost of the coating by approximately 2½ cents per linear foot of the application.

Unloading cost. The cost of unloading drums was estimated at $1.00 per ton. At 40-tons per day average, the added labor cost would have been ½ cent per foot of application.

"Enamel-cost savings were about 2¾ cents per linear foot of application."

The very minimum over-all savings in bulk handling of enamel over drum-packaged deliveries can be estimated at 10% of the total cost of the coating application per linear foot of the pipe. This does not recognize minor savings such as the higher costs of fuel to preheat and maintain the enamel kettles, the cost of enamel-breaking equipment, nor the costs in cleanup.

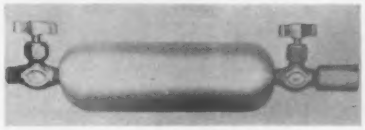
Conclusion

Every method of material handling has its limitations. In trucking hot enamel even in well-insulated trucks, delivery without built-in heaters is limited to approximately 300 miles. The extended residence time of enamel in the truck beyond the 4 hours' travel period created another serious difficulty. Filler ""fallout" occurs unless the truck rigging includes agitators to stir enamel en route. The expense of such equipment would be reflected in the freight charges. The writeoff of this expense on a single coating job limits the size of the job.

Since freight tariffs vary considerably from state to state or from region to region there may be a difference of $1.00 per ton of hauling costs. It may affect the marginal cost advantage of material handling one way or the other.

An economic comparison of both methods has been evaluated with relation to the special conditions encountered on this project. The comparison indicated substantial savings for the bulk-shipped enamel. However, it should not be taken for granted.

All that the authors attempt to indicate in this article is that there are still ways of combating rising costs if one is earnestly and closely watching the opportunities to do so. These opportunities present themselves at various times and cost reduction must be based on these three steps: (1) thorough planning, (2) careful construction, and (3) continuous monitoring of operation.



This type of container means . . .

Greater safety in handling light liquid hydrocarbons

and fewer bad accidents . . .

THE Oil and Gas Journal, June 20, 1960, p. 123, described a laboratory accident at the Mandan, N. D., refiner of Standard Oil Co. (Ind.) in which a sample container ruptured, releasing butane vapors which promptly flashed. No one was injured, but the potential danger was great.

The sample container was an Air Force surplus 1,900-ml.-capacity oxygen container of the type shown at right. Design pressure was 500 psi., and the working-pressure rating was 400 psi.

The container had been filled with field butane at a temperature of about 26° F. and a line pressure of about 220 psi., after which it was brought into the laboratory where the room temperature was 75° F. It is estimated that thermal expansion of the contained liquid resulting from a 49° F. rise in temperature could have subjected the container to a pressure of 1,000 psi. and possibly higher if it had not burst.

Sampling procedure requires venting to assure a vapor space (outage) in the container. Although an operator experienced in sampling field butane had taken the sample, it seems probable that he failed to vent the container after filling it.

Accidents of this type involving light-liquid-hyrocarbon samples are not uncommon. Some of those accidents, unlike the one at Mandan, have been very serious. Consideration of the following information shows why light liquid hydrocarbon samples can be so dangerous. The pressure of contained liquid hydrocarbons increases rapidly with increased temperature. As an example, the pressure of liquid propane will increase from 25 psi. at 0° F. to about 5,000 psi. at 100° F., or about 50 psi. for each degree of temperature rise. If any quantity of LPG vapor is released to the atmosphere, a mixture of vapor and air in the explosive range must be anticipated. For example, 150 ml. of liquid propane will evaporate in air to form an explosive mixture with a volume of 70 cu. ft.

AFTER a potentially serious accident in one of its refineries (see at right), Standard Oil Co. (Ind.) appointed a committee to make a study of the subject of sample containers for light hydrocarbon liquids.

After the committee had completed its report, Standard set up the following general rules for sampling:

Routine Sampling

1. Light hydrocarbon liquids, for purposes of these instructions, are defined as those having a R.v.p. of 18 psi. or more.

2. For sampling light liquid hydrocarbons use Monel metal (ASTM B-165; 70% nickel, 30% copper) sample containers. These containers are to be designed and hydrostatically tested in accordance with Interstate Commerce Commission Specification 3A, with a pressure rating of 5,000 psi. The wall stress shall not exceed 24,000 psi. at service pressure. Containers are to be equipped with suitable high-pressure forged-steel valves, and are not to be equipped with reentrant tubes.

3. For routine sampling of light liquid hydrocarbons, no sample containers larger than 150-ml. nominal capacity shall be used. Under special circumstances, containers as large as 300-ml. nominal capacity may be used; specific authorization for each case must be obtained from the authority designated by the refinery manager.

4. The usual sizes of sample containers are to be 75-ml., 150-ml., and 300-ml. nominal capacity. For special purposes, containers smaller than 75 ml. may be used routinely at the discretion of individual laboratories.

5. All sample containers are to be hydrostatically tested to 8,000 psi. at least once every 5 years. Also, all sample containers are to be visually inspected for internal corrosion whenever a valve is replaced or repaired, or more often if required. If visual inspection reveals corrosion, the container is to be tested to 8,000 psi. before it is returned to service, and at intervals of 6 months thereafter. If a container is damaged, it is to be tested to 8,000 psi. immediately. A con-

BY J. C. DUCOMMUN
Standard Oil Co. (Ind.)
General Manager, Manufacturing,

tainer is to be discarded if it is permanently deformed by the 8,000-psi. test.

6. Samples are to be taken only by properly trained personnel, and only with the specific knowledge of the stillman or operator responsible.

7. Containers are to be prepared before sampling so as to avoid producing an explosive mixture within the container either before or during sampling. A nitrogen purge is satisfactory.

8. Direct and uncomplicated procedures for taking light-liquid-hydrocarbon samples are to be established and put into effect at all locations. Any deviation from standard practice must have approval of the authority designated by the refinery manager.

9. In all cases, these should be outage of about 20% before the sample container is taken away from the sampling location.

10. Sample containers are to be transported in trays or carriers designed to protect the valves from damage.

11. When a sample container is received at the laboratory, it is to be weighed immediately to confirm that the outage is at least 20%. Adequate records are to be maintained by the laboratory which will permit a good estimate of the sample volume based on the weight of sample taken. Containers which are more than 80% full are to be vented (liquid withdrawn) with proper safety precautions to achieve 20% minimum outage. See item 14.

12. The laboratory at each location will be responsible for assuring that valves on sample containers and sampling apparatus are in good condition. It is recommended, but not mandatory, to plug both container valves after the sample has been obtained. (Plugs are to be only finger tight.) The laboratory will also check all filled containers for leakage after the containers have been weighed and the outage adjusted.

13. Filled sample containers are to be kept under refrigeration or out-of-doors (shaded) until analysis is begun.

14. When an analysis is completed, the sample container is to be slowly vented and purged so as to dilute the hydrocarbon vapors immediately and to discharge them well away from buildings or possible sources of ignition.

Special Sampling

Circumstances may sometimes require more than 300 ml. of light liquid hydrocarbon.

If samples of refinery origin are not required, light liquid hydrocarbons (such as isopentane and n-butane) are to be purchased from commercial sources in ICC-approved containers. These containers are to be weighed on receipt at the laboratory to confirm proper outage.

If samples of refinery origin are required, it will be the responsibility of the department desiring such samples to make adequate provision for safe sampling and handling.

Minimum requirements are:

1. The operating supervisor and the stillman responsible for the location from which the sample is to be taken are to be notified in advance of such sampling.

2. As a minimum all sampling containers should conform to ICC specifications suitable for the temperature and pressure anticipated and the sample to be handled (ASME design basis would also be satisfactory).

3. The sampling should be carried out under the direct attention of qualified personnel.

4. The sample containers should be prepared before sampling so as to avoid producing an explosive mixture within the sampling container either before or during the sampling operation.

5. Precautions should be taken to insure about 20% outage either by weighing during the sampling operation or by volume measurement of immiscible liquid displacement.

These instructions are not presumed to cover every step involved in taking, handling, and using light hydrocarbon samples, as the characteristics of the sampled material, conditions at the sampling site, and laboratory facilities will vary considerably.

These instructions are basic and require supplementary directions by each laboratory head. In particular, note that the actual testing method is not prescribed. It will often be necessary to transfer part of the sample from the original container to some special container for certain tests. For instance, there is a test procedure for commercial LPG that specifies the design and material of the container.

It is natural to question why a container for sampling light liquid hydrocarbons can not be designed like commercial LPG storage vessels which have proved themselves thoroughly. The answer lies in several factors. Commercial LPG tanks which usually remain outdoors while their contents are consumed, can be protected by pressure-relieving devices. Their adequacy is attested to by their safety record.

In the case of the refinery sample container, we are not concerned merely with avoiding damage to the container, but must prevent accidental release of light hydrocarbon in the laboratory. Therefore, use of a pressure-relieving device would defeat our purpose.

The committee chose a design basis for sample containers which will provide maximum safety but will not result in excessive cost. Monel metal was chosen for the material because of its corrosion resistance and its good physical properties. In case of moderate overpressuring this material will elongate and by increased volume will reduce the pressure.

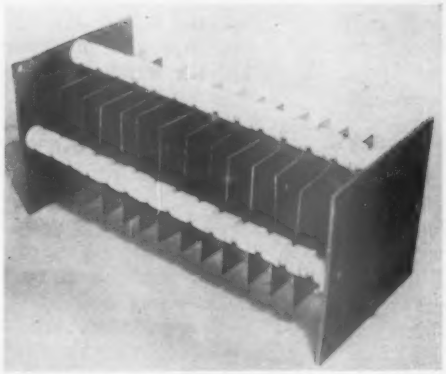
A 5,000-psi. pressure rating was selected as a design basis so that the container would not fail even with no outage. For sample containers of limited capacity, the wall thickness required is not excessive.

"In the case of the refinery sample container, we are not concerned merely with avoiding damage to the container, but must prevent accidental release of light hydrocarbon in the laboratory. Therefore, use of a pressure-relieving device would defeat our purpose."

How research on steel corrosion is

Reducing costs in the petroleum industry

BY DR. E. H. PHELPS
Assistant Division Chief,
Chemical Metallurgy,
United States Steel Corp.
Applied Research Laboratory



CORROSION TEST RACK and 4-in.-square specimens. Fig. 1.

CORROSION RESEARCH is a large part of the steel industry's research budget. The petroleum industry benefits because the results are the means by which corrosion costs can be reduced.

A few of the results of the corrosion-research program on steel are:

- A new steel with improved corrosion resistance.
- A new technique to minimize corrosion.
- Data showing which steel to use in a specific corrosive media.

Service Tests in Process Equipment

Corrosion tests of various materials in process vessels establish corrosion behavior in plant environments and conditions. It is difficult to reproduce service conditions in the laboratory because of the many variables that can influence corrosion.

Corrosion test racks have been furnished and installed in various types of refinery vessels. Table 1 lists some refinery equipment where corrosion tests have been conducted.

TABLE 1—COOPERATIVE CORROSION TESTS IN REFINERY EQUIPMENT

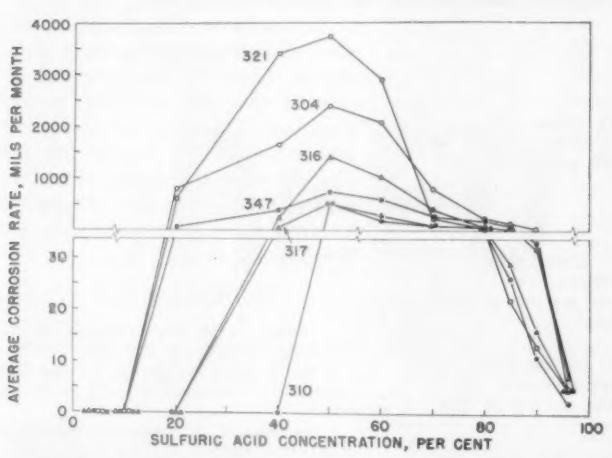
Furfural absorbers.
Secondary vacuum flasher (vacuum distillation of primary pitch).
Main fractionator tower of catalytic cracking unit.
Pitch section of vacuum-flasher chamber.
Sour water stripper.
Boiler-feed water.
Bottoms of sour crude tanks.
Overhead condenser tower.
Secondary tower of catalytic cracking unit.
Alkylation unit.
Depropanizer tower.

The specimens used in these tests represent a range of steel composition from structural carbon steel to high-alloy stainless steels. The specimens are mounted on corrosion test racks. A common type of test rack is shown in Fig. 1.

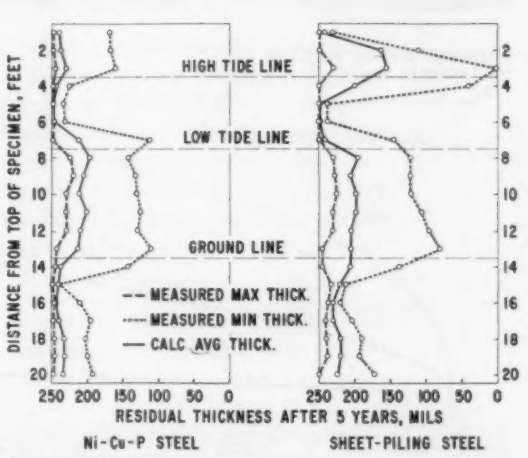
Welded specimens are included in the test specimens to detect any special effects of welding on corrosion.

The test racks containing the weighed specimens are installed in the process vessels by the refinery's engineers. After the tests are complete, the racks with specimens intact are returned to U. S. Steel's applied research center.

The corrosion products are removed and the specimens are reweighed. Microscopic and metallugraphic tests find which type of corrosion attack occurred. When the



AVERAGE CORROSION RATES of various annealed, passivated stainless steels in air-saturated sulfuric acid at 70° C. (Note change of scale.) Fig. 2.



MAXIMUM AND MINIMUM thickness at 1-ft. intervals of Ni-Cu-P steel and sheet piling steel after 5-year exposure to sea water. Fig. 3.

examinations are complete, the results are sent to the refinery.

Corrosion test rack results are used to find the most suitable construction material for the equipment when replacement is necessary and to help predict expected service life of equipment.

Laboratory Investigations

Laboratory corrosion tests should not be used to predict directly the performance of steels in service; however, they can be used profitably to find comparative performance under controlled conditions.

Comparative data are of practical assistance to the designer because they help establish a reference to aid in material selection.

An extensive series of tests was conducted to find comparative corrosion rates of sulfuric acid on various types of austenitic stainless steel.[1] An example of the results obtained at one temperature are shown in Fig. 2 and is indicative of the behavior at other temperatures. These data show that the steels remain passive (negligible corrosion rate) until reaching a critical sulfuric acid concentration.

Tests at greater concentrations result in an excessively high corrosion rate for any given alloy except at very high acid concentrations. In general, the acid concentration range where steels remain passive increases as the alloy content increases. The active-passive behavior can help explain why seemingly minor changes in process conditions can sometimes result in unexpectedly large changes in corrosion behavior.

Recent studies by one oil company show that the stainless-steel application range in some chemical environments, such as sulfuric acid, can be extended by an impressed anodic current.[2] A passive condition is maintained in environments in which the steel would normally corrode fast in the active condition.

Marine Corrosion

Marine corrosion is important because of increased offshore drilling. The corrosion of steels in sea water has been the subject of many investigations. It was shown only recently that "splash zone" corrosion of certain experimental steels was much less than structural carbon steel.

The splash zone is where sea water intermittently immerses or occasionally splashes a structure. Corrosion of carbon-steel piling is most severe in the splash zone of seawater installations.

In 1951, quadruplicate specimens 20 ft. long by 6 in. wide of six different Ni-Cu-P (nickel-copper-phosphorus) experimental steels and of carbon steel (piling grade) were exposed to sea water at International Nickel Co.'s Harbor Island testing station at Wrightsville Beach, N. C.

The tops of the specimens extended above the splash zone and the bottoms were in the mud. A specimen of each steel was removed after 1, 2, and 5-year exposures, and was cleaned and examined.

The program results indicate that the experimental Ni-Cu-P steels as a class have much more corrosion resistance to conditions existing in and above high tide than sheet-piling steel.[3] The experimental steel that appears consistently most resistant in the splash zone contains 0.5% Ni, 0.5% Cu, and 0.12% P.

The maximum and minimum thicknesses, at 1-ft. intervals, of this steel and sheet piling steel after 5-year exposure are shown in Fig. 3. The residual thicknesses, calculated from weight losses, are between the two extremes.

The apparent resistance to pitting attack in the splash zone of the Ni-Cu-P steel is at least three times that of the sheet-piling steel.

In addition, comparative corrosion test samples of carbon steel and a 100-ton heat of Ni-Cu-P steel were exposed at several other locations. Some of the comparative tests are on offshore drilling rigs.

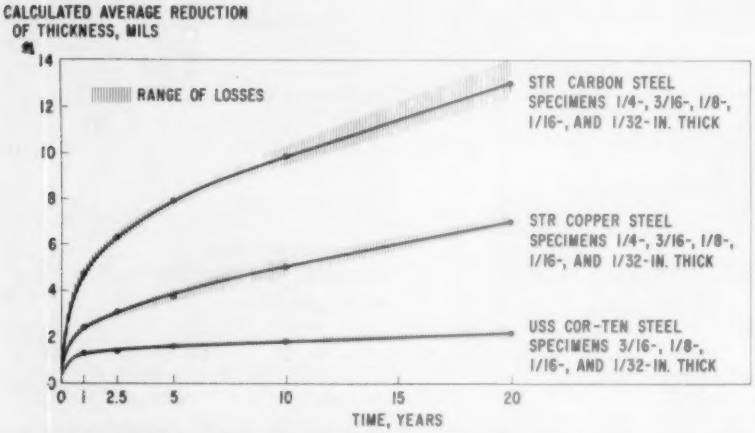
The use of this steel for structural sections could reduce periodic maintenance cost on the portions of these rigs above high tide.

Durability of Paints

Maintenance and repair of structural steel can represent a large cost in any refinery or petrochemical plants. A big part of the cost is associated with corrosion of structural steel, and paints are used generally to prevent corrosion of structural steel.

Steel composition has a pronounced effect on atmospheric-corrosion resistance as shown by long-term tests. Comparative behavior in an industrial atmosphere shows a high-strength, low-alloy steel that is 4 to 6 times more resistant to atmospheric corrosion than structural carbon steel, and 2 times that of structural copper steel, Fig. 4.

Atmospheric resistance of the steel is an important factor in paint life as shown by exposure tests on painted specimens of these steels.[4] Paints applied to high-strength, low-alloy steel had the longest life, applied to structural copper steel they had an intermediate life, and applied to structural carbon steel they had the shortest life.



THE HIGH-STRENGTH, LOW-ALLOY STEEL has four to six times more atmospheric corrosion resistance than structural carbon steel. Fig. 4.

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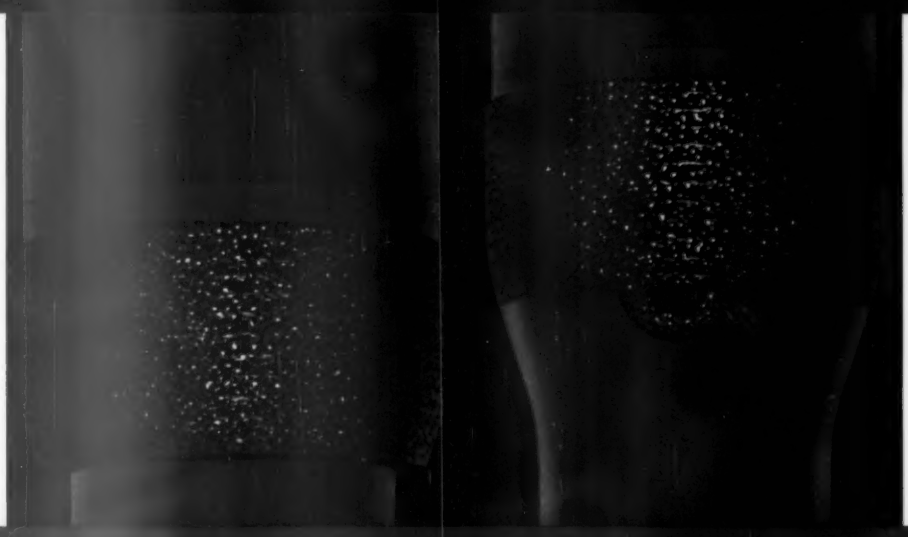

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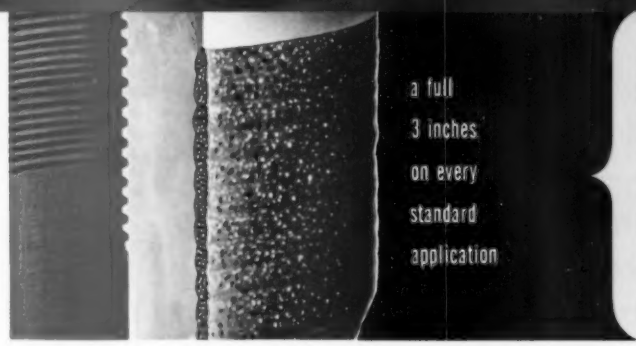

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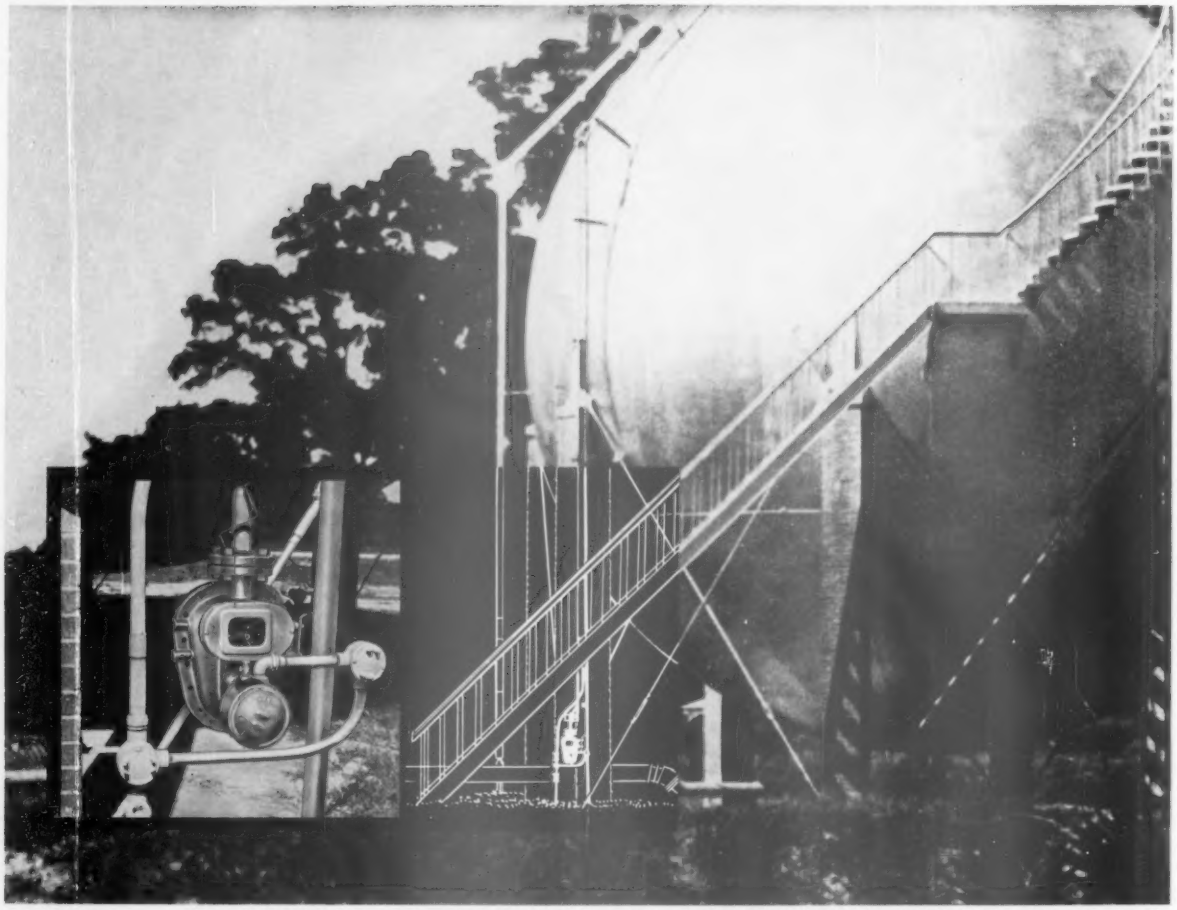

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BY W. L. NELSON Technical Editor and Petroleum Consultant

References on technology of carbon-black manufacture

Where can I find information on the design, construction, and operation of carbon-black manufacturing plants, also information on the quality, grading, and uses of carbon black? E.K.

The detailed type of information that you desire is not available, because relatively few plants of each type are built and therefore such data are often considered as confidential.

Perhaps the most complete general summary appears on pages 821, 830-833, and 843-845 of Petroleum Refinery Engineering, 4th Ed., McGraw-Hill Book Co., Inc., New York, 1958. This rests considerably on the first seven references tabulated below. Somewhat more detail is presented in References 8-18 which appeared on the Questions on Technology page. References 19 - 25 each contribute something to the technology of black manufacture.

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Reformate sensitivity varies widely

What is the sensitivity of catalytically reformed gasoline? We get quite low values in our plant compared with the literature. G.F.M.

Many types of chemical reactions are involved in catalytic reforming and the operating conditions of the process can be altered to some extent to foster cracking, isomerization, hydrogenation, or even dehydrogenation. The great variations in sensitivity to which you refer are possibly due to the predominance of one or another of the chemical reactions just enumerated. The great range of sensitivity is evident in Fig. 1. Susceptibility is also shown on Fig. 1.

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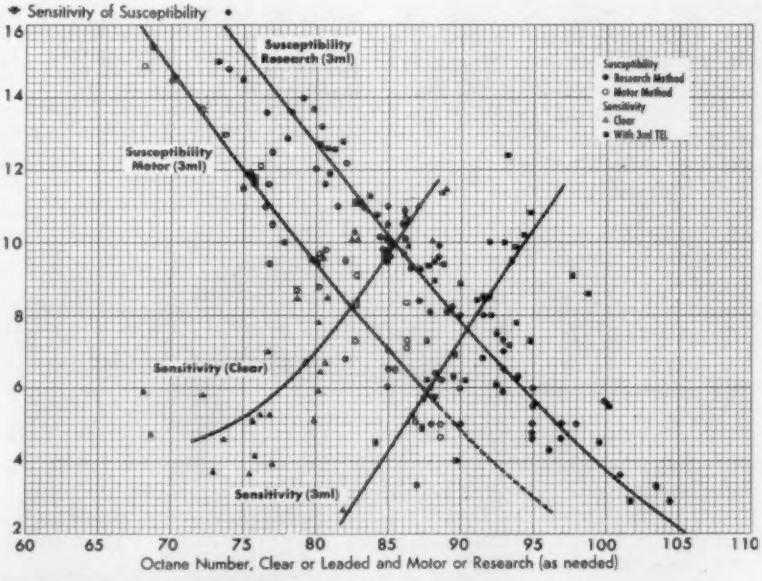


SENSITIVITY AND SUSCEPTIBILITY of catalytic reformates. Fig. 1.

Reaction-mix sampling simplifies analysis of cat cracker for California Standard

• Experience shows that this method is reproducible and more accurate than conventional net stream analysis.

• A complete plant analysis can be made for less than $200 including the time required for sampling and calculating results—an appreciable saving over conventional methods.

BY R. L. FLANDERS, R. J. ANNESSER, AND D. A. SAVILLE
California Research Corp., Richmond, Calif.

HOW MANY of these complications make an analysis of your catalytic cracker difficult?

- Two reactors feeding a common recovery train.
- Crude-unit gas processed in recovery section.
- Two adjacent recovery plants with crossover lines.
- Offtest stock rerun in the fractionator.
- Corroded sample points around the depropanizer and absorber.
- Critical fractionator meters in bad order or with no current calibration.

A yield-analysis scheme developed by California Research Corp. is now in service in all of the moving-bed and fluid catalytic cracking units of Standard Oil Co. of California.

The scheme, called "reaction-mix analysis," avoids all of these problems and is cheaper by a factor of three than conventional analysis of the net plant streams. Necessary samples can be drawn by one man in 2 hours, and the analytical department must process only one flue gas, one hydrocarbon gas, and one liquid hydrocarbon sample.

Basic Principles

The reaction-mix sample method is based on withdrawing a sample of the hot reactor-effluent vapor, cooling the sample, then measuring and analyzing the resultant gas and liquid portions.

Reactor effluent is virtually 100% vapor, but it may contain small amounts of catalyst or condensed hydrocarbon in the form of a mist. Usually, any liquid hydrocarbon is uniformly dispersed; therefore, it is possible to draw a representative sample of this stream.

Basic idea of the reaction-mix method is to draw a sample at a slow enough rate so that **all** of the sample over a period of about 20 minutes can be processed through the sample-recovery train.

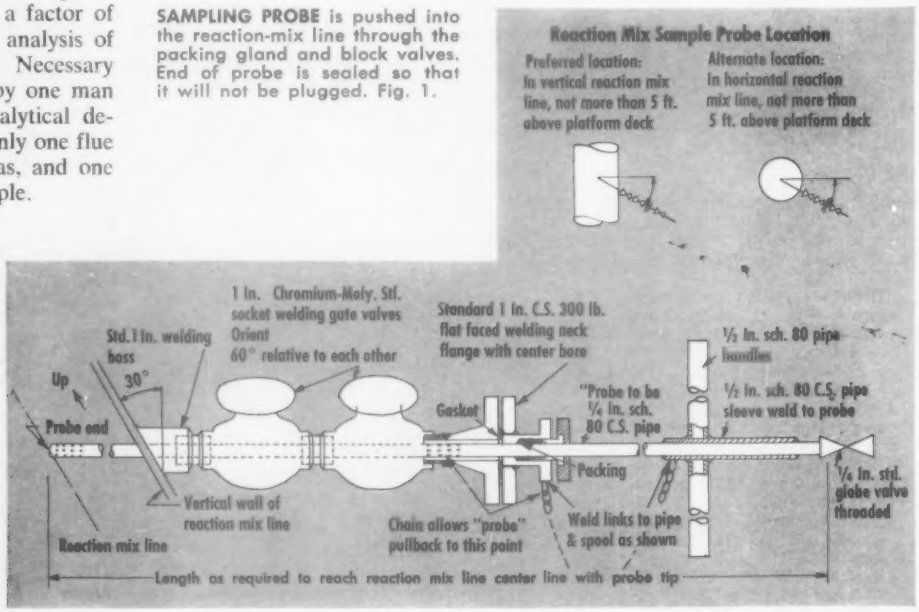
Other schemes have been tried wherein a sizable stream is piped to the blowdown system and a portion sampled for analysis. These schemes do not work satisfactorily because it is extremely difficult to get a representative sample from a mixed-phase system.

Another important principle is that only natural air convection cooling is used, and pipe and sample sizes are kept small. Water coolers plug when waxy stocks are used and large pipe sizes may permit gas to bypass liquid, thus giving a nonrepresentative sample.

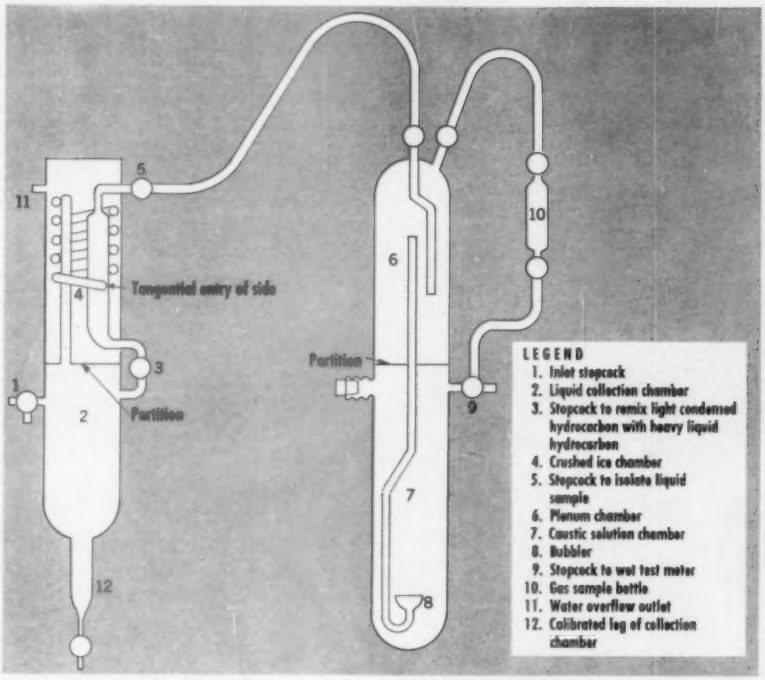
Equipment

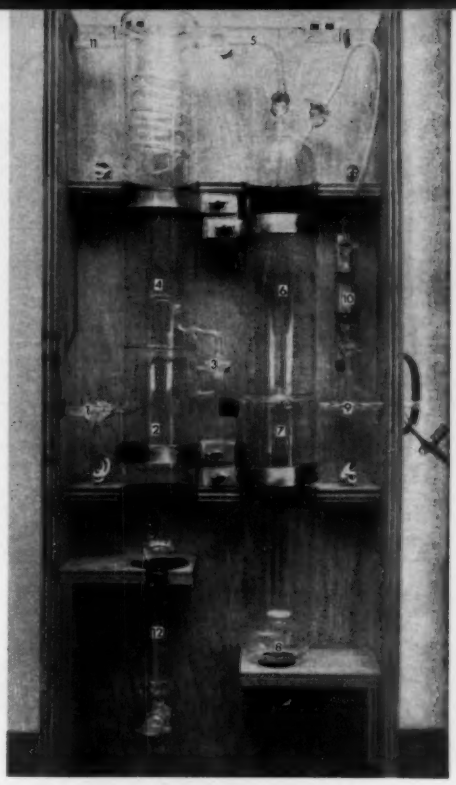
Necessary equipment includes:

- A sampling probe such as shown in Fig. 1.
- A sample-receiving train shown schematically in Fig. 2. In practice, the glassware is mounted in a suitcase-sized box for easy transport and quick setup at the sample point. The kit is shown in Fig. 3.
- Laboratory distillation facilities including an analytical method


Reaction Mix Sample Probe Location
Preferred location: In vertical reaction mix line, not more than 5 ft. above platform deck
Alternate location: In horizontal reaction mix line, not more than 5 ft. above platform deck
1 In. Chromium-Moly. Stl. socket welding gate valves Orient 60° relative to each other
Standard 1 In. C.S. 300 lb. flat faced welding neck flange with center bore
½ In. sch. 80 pipe handles
Std. 1 In. welding boss
30°
Up
Probe end
Gasket
"Probe to be ¼ In. sch. 80 C.S. pipe
½ In. sch. 80 C.S. pipe sleeve weld to probe
Packing
¼ In. Std. globe valve threaded
Vertical wall of reaction mix line
Reaction mix line
Chain allows "probe" pullback to this point
Weld links to pipe & spool as shown
Length as required to reach reaction mix line center line with probe tip

SAMPLING PROBE is pushed into the reaction-mix line through the packing gland and block valves. End of probe is sealed so that it will not be plugged. Fig. 1.


Tangential entry of side
Partition
Partition
LEGEND
1. Inlet stopcock
2. Liquid collection chamber
3. Stopcock to remix light condensed hydrocarbon with heavy liquid hydrocarbon
4. Crushed ice chamber
5. Stopcock to isolate liquid sample
6. Plenum chamber
7. Caustic solution chamber
8. Bubbler
9. Stopcock to wet test meter
10. Gas sample bottle
11. Water overflow outlet
12. Calibrated leg of collection chamber



SAMPLE-RECEIVING TRAIN is installed on a nearby operating platform. Apparatus can be conveniently made up in kit form so that it can be carried easily and set up quickly at sample site. Figs. 2 and 3.

for light-ends breakdown.

• Orsat apparatus or gas chromatograph for flue gas.

Sampling Procedure

The steel probe is pushed into the reaction-mix line through the packing gland and block valves. Since coke and catalyst tend to accumulate just inside the valve, this deposit must be broken to allow the probe to be inserted into the center of the line.

Note the end of the probe is sealed so the probe itself may be used to rod out a hole and not be plugged in the process. In some installations, however, the probe tip is left open to facilitate cleaning. In either method the desired gases enter the probe through holes in the probe near its tip.

A short copper-tubing run is installed from the probe to a convenient operating platform. This run should be 6 to 10 ft. of ¼-in. bare copper tubing. Connect the tubing to the recovery train.

Gas leaks around the packing gland do not interfere with sampling. However, no gas leaks can be tolerated from the probe tip through the entire copper-tubing run. Leaks here would cause preferential loss of light ends and gases.

The receiving train shown in Fig. 2 is next tested to be reasonably pressuretight. Adjust the sampling rate into the slop bucket to 40-50 cc. per minute by throttling with the valve on the probe. Run for 10 to 15 minutes to allow the sampling line to come to a steady temperature. Liquid will be received at about 100° F. under these conditions.

Sampling procedure normally consists of a purge cycle followed by a test cycle.

Purge cycle. This cycle is used to assure steady flow rates and to displace the gas in the system remaining from the previous test. Following the purge cycle, all liquid product is dumped and the gas meter is zeroed.

Test cycle. Referring to Fig. 2, divert the whole reaction-mix product by means of three-way cock 1 into the recovery train.

Cock 1 shunts the sample to the liquid collector 2 or to slop.

Chamber 4 is separated from 2 by a partition and is filled with a crushed-ice slush. Overflow of water is handled through line 11.

Vapors and gas from 2 flow up a riser through 4 and downward through a cooling coil into a light-ends accumulator located in the crushed-ice slush. Cock 3 is closed during the sampling period.

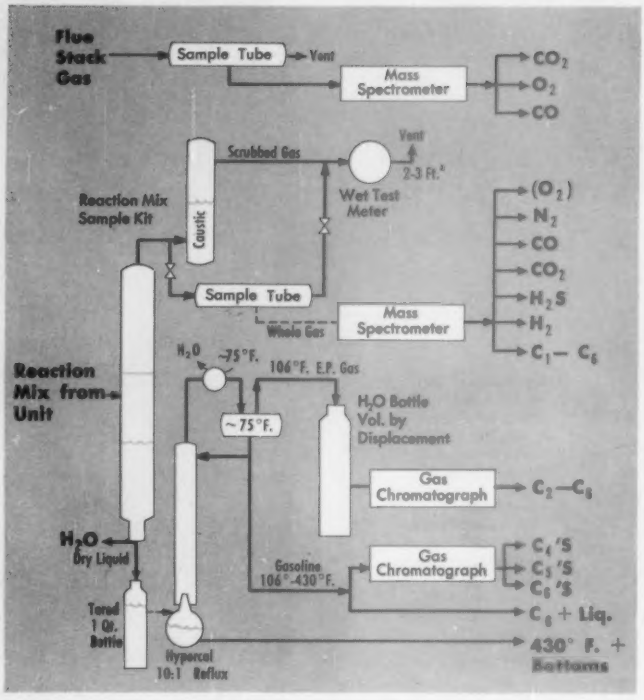
Gases and uncondensed light ends flow from the light-ends accumulator through cock 5 to plenum chamber 6.

From 6, gases flow from a downcomer to bubbler 8 then bubble upward through chamber 7 which is half filled with 1N. caustic solution for H_2S removal. (The caustic protects the wet-test-meter internals from H_2S corrosion.)

Scrubbed gas flows out cock 9 and is metered through a wet-test meter not shown.

Reaction-mix gases can either be taken during the run by bypassing a small amount of unscrubbed gas from plenum chamber 6 through gas-sample bottle 10 or can be obtained at the end of the test by displacement of a portion of the plenum-chamber gas. Gas is displaced through the sample tube by blowing. Air introduced into the sample by blowing does not interfere with the hydrocarbon analysis and is preferred to water displacement when an H_2S value is required.

At completion of a sample run, cock 1 shunts the reaction-mix flow to slop. Cock 5 is closed, isolating



OUTLINE of a possible analytical procedure. Combining analytical results with three plant flow rates permits an accurate description of plant performance. Fig. 4.

the liquid sample.

Cock 3 is then opened, mixing the condensed light ends with the reaction-mix liquid.

Reaction-mix water is read in the calibrated leg 12, and then drained off.

The entire water-free reaction-mix hydrocarbon is then transferred to a sample can for later analysis.

The wet-test gas meter is read for gas volume, and the gas sample in bottle 10 taken for analysis.

Note atmospheric pressure and gas-meter temperature for later use in calculating the standard gas volume.

Draw samples of plant feed, recycle, and other stream samples in sufficient volume to provide all inspections desired.

Analyze a sample of flue gas for CO_2, CO, and O_2 by Orsat or chromatograph.

Analytical Procedure

A possible analytical procedure is outlined in Fig. 4. Steps are:

1. Obtain the weight of the total liquid hydrocarbon sample.

2. Charge the hydrocarbon portion of the liquid to a laboratory TBP still and take cuts at 106° and 430° F.

3. Analyze the sample of reaction-mix gas and the start-to-106° F. cut by mass spectrometer or gas chromatograph.

4. Obtain the gravity of the 106°-430° F. and 430° F. + liquid cuts for use in converting the yields to a weight basis. Inspections of the 106°-430° F. gasoline may be obtained, limited only by the volume of this material available. This stream will not include the C_5's, and appropriate adjustments must be made to the inspections obtained.

5. Inspect the plant feed, recycle, and other product samples as desired.

Calculation Procedure

An accurate description of plant performance using the reaction-mix technique is obtained by combining the analytical results with three plant flow rates. These flow rates are obtained from meter readings of the fresh-feed rate, recycle rate, and regenerator-air rate.

Here's the procedure:

1. Determine the weight of plant feed and recycle from the plant meter readings, corrected both for variations from design conditions and API gravity of the feed and recycle samples.

2. Determine the rate of coke production from the air rate to the regenerator and Orsat analysis of the flue gas. Carbon content is derived from the CO_2 plus CO contents; hydrogen content is derived from the disappearance of oxygen relative to nitrogen. If an air-line burner was in use, appropriate corrections must be made.

3. Combine these rates in the total material-balance equation to determine total reaction-mix flow rate. $Q = F + R - C$

Where:

F = fresh-feed rate, lb./hour (determined in 1)

R = recycle rate, lb./hour (determined in 1)

C = coke-production rate, lb./hour (determined in 2)

Q = total reaction-mix rate, lb./hour

4. Combine results of the reaction-mix gas analysis with the distillation results to express the individual yields as weight per cent of the reaction-mix stream sample.

5. The reaction-mix sample is assumed to be representative of the total reaction-mix product; hence, individual yields can be calculated as a per cent of the fresh or total feed streams, using the results of steps 3 and 4.

6. Results are converted to a volume basis using the measured API gravities.

Precision of Results

Precision of the individual results is dependent upon precision of the meter readings and analytical results.

For a typical case at 100% recycle the precision of the results, expressed on a fresh-feed basis, has been estimated below:

Yield, Wt. % ± estimated error, Wt. %	
Light gases	0.1
Butanes-Butenes	0.2
Gasoline, (C_5 – 430° F.)	1.0
Coke	0.3
Conversion	1.0

Acknowledgments

The contributions of H. E. Knowlton and J. G. Girard were noteworthy in reducing the technique to its present simple form. W. R. Doty cooperated in the development of the glassware in the sample kit. Appreciation is also given to the Technical Service Group of the California Research Corp. for its assistance in developing this technique and in preparing this paper.

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How to add **Refrigeration** to existing **gas-processing plants**

and thus . . .

- save on plant fuel
- reduce capital investment
- reduce operating labor
- reduce operating troubles due to absence of water

BY C. P. STANLEY
Dresser Engineering Co.,
Tulsa

DURING the past several years, the trend in gas-processing-plant design has definitely been away from atmospheric - temperature - absorption plants to refrigerated - absorption plants. The increased value of gas, along with general economics of this industry, has forced designers and operators to look for more efficient and cheaper methods of LPG production.

The big advantages of refrigeration over atmospheric temperature processing are the saving of plant fuel, reduction in capital investment, reduction in operating labor, and reduction in operating difficulties due to absence of water.

In order to increase propane extraction in existing gasoline plants by refrigeration, the following steps are normally used:

Paper presented before the NGAA regional meeting in Amarillo, November, 1960.

1. Dehydrate inlet gas or use glycol injection.
2. Add refrigeration system to refrigerate both oil and gas.
3. Add heat exchangers to oil and gas from absorber to recover refrigeration.
4. Eliminate steam stripping by using lower-molecular-weight absorption oil and use of furnace heat at the still base for oil stripping.

Dehydration. To prevent hydrate formation when cooling gas below 60° F. at normal absorber pressures, it is necessary to first dehydrate the gas with solid desiccants or glycol, or to inject glycol into the gas before refrigerating. Glycol injection is normally much cheaper to install, and is satisfactory if a three-phase separator is used upstream of the absorber to remove the glycol.

Refrigeration. The most popular type of refrigeration is a propane compression cycle. Ammonia and freon are also used in compression cycles and require slightly less horsepower per ton of refrigeration, but most operators prefer propane because of the ready availability and lower cost of makeup refrigerant.

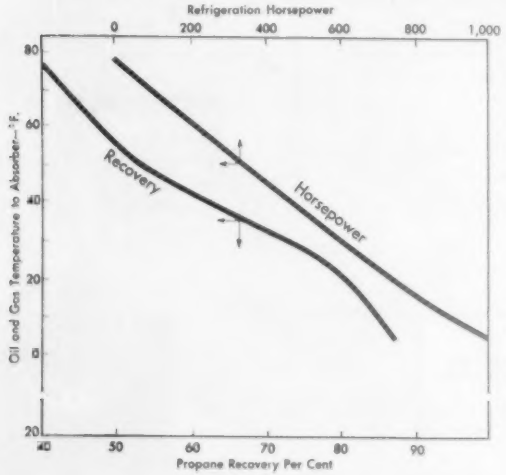
The ammonia-water absorption cycle is sometimes used, but normally requires considerably more heating and cooling load, and usually is uneconomical unless waste heat is available from other sources.

In existing plants, the oil circulation is often fixed by existing pumps, towers, and other equipment. So, additional propane extraction is most economically obtained, in most cases, by using the same oil circulation and refrigerating both gas and oil. With fixed oil circulation, the lower the temperature used, the higher the propane recovery, and of course, more refrigeration horsepower is required.

Heat exchange. To best utilize refrigeration horsepower cold heat exchangers are necessary on both gas and oil. The cold gas exchange will cool the incoming gas before it goes to the chiller by heating the absorber residue to within 10° to 15° F. of the incoming gas. The oil exchanger will cool the oil before it goes to the chiller to 10° or 15° F. above the absorber-base temperature by heating the rich oil from the absorber. Fixed tube-sheet exchangers are desirable in these services since temperature differences are small and true countercurrent flow is advantageous.

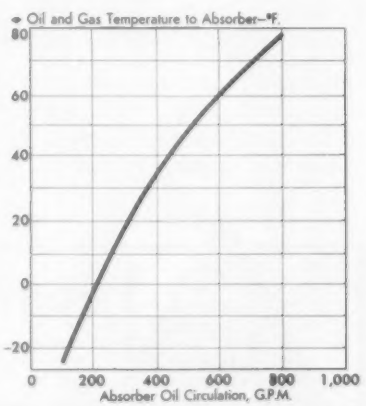
Stripping. To prevent addition of water to the oil, which would result in formation of hydrates in the absorber, it is desirable to eliminate steam stripping and use straight heat for stripping.

It is generally conceded that, in a single-still system, 155 to 160-



PROPANE RECOVERY and refrigeration horsepower, assuming fixed oil circulation, will vary with absorber temperature as shown by these two curves. Fig. 1.

VARIATION of oil circulation with absorber temperature, assuming 75% propane recovery, is shown in this chart. Fig. 2.



mole-wt. oil is the heaviest practical to use without use of steam or other stripping medium. The lightest oil practical is that which will not give excessive losses at the absorber pressure and temperature. In most gasoline plants this is not below 125 mole wt.

Losses of 130-mole-wt. oil in residue gas at −10° F. absorber temperature are comparable to losses of 180-mole-wt. oil at 90° F. absorber temperature.

Application. An actual plant case has recently been studied which is getting about 40% propane recovery with atmospheric temperature absorption. This plant has 48-M.M.s.c.f.d. gas throughput, an oil circulation to absorber and deethanizer of 500 g.p.m., and a present production of 28,000 gal. per day of propane, and 31,000 gal. per day of butanes plus. The absorber pressure is 450 psi. and the oil used is 200 mole wt.

Reference to Fig. 1 will show how the calculated propane-recovery and compressor horsepower varies with the temperature.

To further explore the process variables for this plant the oil circulation was calculated at various temperatures to give a constant 75% propane recovery. Results of this study are shown in Fig. 2.

To establish an optimum refrigeration temperature, it is necessary to calculate construction costs and revenues, considering increased fuel and other operating costs, for two or three refrigeration levels.

It should also be realized that less methane and ethane are absorbed per gallon of propane at lower temperature, making deethanization easier and minimizing recompression of light gases back to residue.

The optimum recovery point is influenced by absorber pressure, richness of gas, cost of fuel, selling price of propane, and capacity of other plant equipment and towers, such as the deethanizer, still, and depropanizer.

Increasing propane recovery almost always results in need for more capacity in the still and depropanizer, and addition of more condensers to both these towers.

It is quite often possible to retray old towers and increase throughput as much as 30 or 40%.

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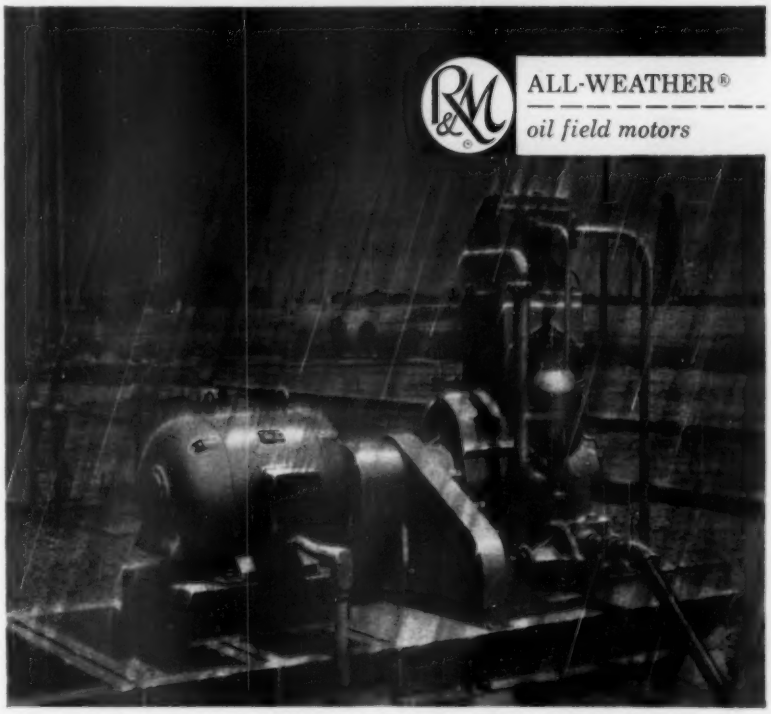

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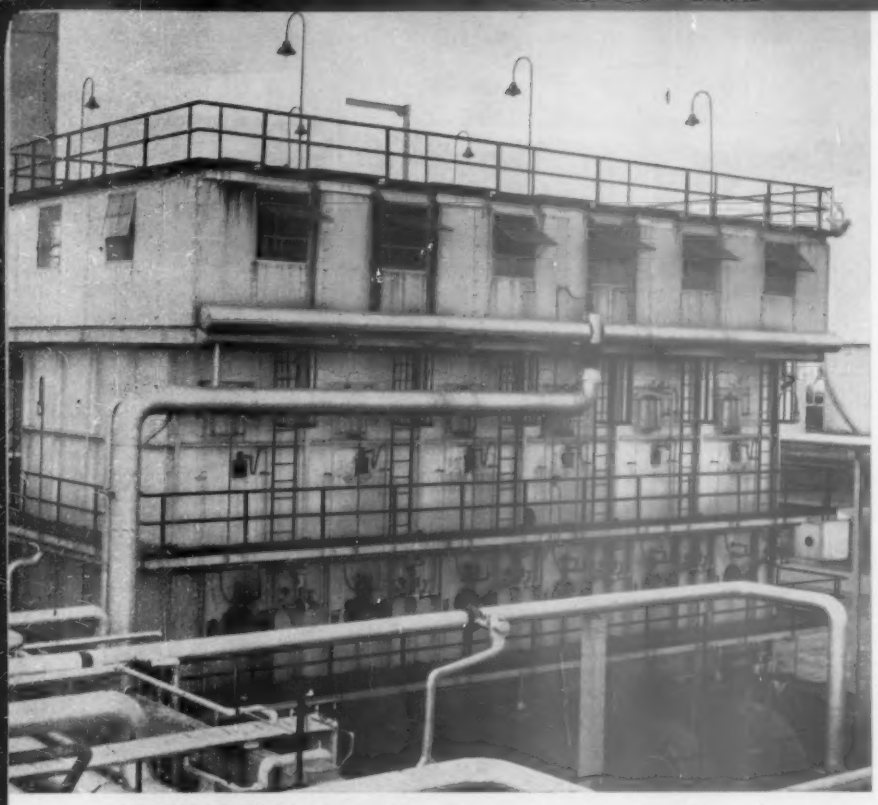


ONE OF THE TWO hydrogen-plant reforming furnaces. Each of the mirror-image furnaces contains 180 30-ft. tubes supported vertically by heavy springs in the penthouse. Large ducts at lower right carry away the flue gas from the six separate cells. Plant was licensed by Girdler Construction Corp.

PROGRESS REPORT on...

Tidewater's big hydrogen plant

BY D. H. STORMONT
Refining Editor

THREE YEARS' experience with the oil industry's largest hydrogen plant has shown Tidewater Oil Co. that such plants offer a dependable, efficient source of hydrogen.

The plant is located at the 140,000-bbl. Delaware refinery, south of Wilmington, which was designed to operate on low-gravity, high-sulfur crudes. Supplemental hydrogen capacity, to the extent of about 30 M.M.c.f.d., was needed to carry out hydrodesulfurization of several products and intermediate fractions.

All of this hydrogen capacity has not been needed due to Tidewater's inability to import sufficient heavy Middle Eastern crudes. Only one train of the two-train unit has been required for the types of crudes used. Both trains, however, have operated for prolonged periods, more than meeting design specifications in volume and quality.

Process description. As shown in the simplified flow diagram, the plant consists of two essentially parallel units of 15-M.M.c.f.d. capacity. In the reforming furnaces, the hydrocarbon feed and steam are converted into hydrogen, carbon dioxide, and carbon monoxide. Effluent composition of about 80% hydrogen, 10% CO, and 10% CO_2 is obtained.

Upon leaving the reforming furnaces, the hot gases are cooled (by injecting condensate) and run to first-stage shift converters. There, more hydrogen is produced as a result of the steam-carbon monoxide reaction. After most of the CO_2 is removed in hot-potassium carbonate scrubbers, the gases are again mixed with steam and run to the second-stage shift converters.

Carbon dioxide produced in this phase is removed by scrubbing with MEA solution. If needed, remaining traces of CO and CO_2 are then removed in the methanators. However, the CO and CO_2 level in the product hydrogen is sufficiently low for use over desulfurization catalyst without methanation.

In initial operations, a refinery propane stream was used as charge to the reforming furnaces. Since then natural gas has become available and is now used as a portion of the feed after traces of sulfur compounds have been thoroughly removed in an activated-carbon scrubber. A propane-and-lighter cut from the catalytic reformer-depropanizer overhead is occasionally used as total or partial feed. This stream contains about 45% propane.

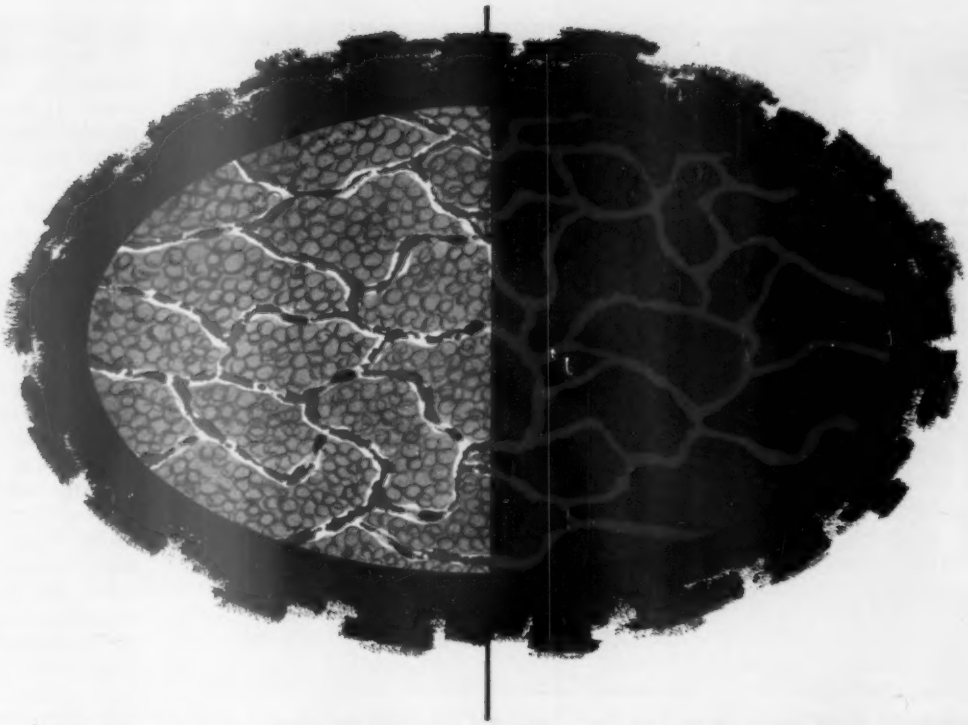
The hydrogen plant was placed in operation in late 1957. As of last September 30, one train had been on stream 448 days and the other had completed 503 days' service. Each unit had an average output of about 10 M.M.c.f.d., producing hydrogen of 98% or higher purity. As much as 18 M.M.c.f.d. has been produced by a unit. Purity of the product has run as high as 99% plus.

Reforming furnaces. Because of an unusual corrosion problem experienced with the tubes of one reformer, a brief description of the two furnaces is in order.

The furnaces are an induced downdraft design, with burners on top and at the ends of each of the six cells into which they are divided. Each contains 180 vertical 30-ft. tubes packed with nickel reforming catalyst. Operating pressure in the ½-in.-wall tubes is approximately 125 psig. Skin temperature of the tubes ranges about 1,550°-1,700° F., with outlet temperatures of the gas stream reaching approximately 1,350° to 1,450° F.

Because of the high-temperature conditions, centrifugally cast 25% Cr-20% Ni tubes were selected for both furnaces. Shortages of this material resulted in one furnace being equipped with extruded Incoloy (34 Ni-21 Cr) alloy tubes. As they were available only in lengths up to 15 ft., the tubes were fabricated by double-jointing.

Reformer corrosion. Soon after the reformer with the high-nickel



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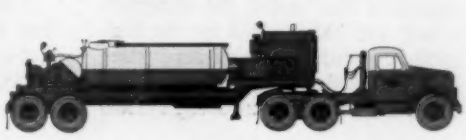
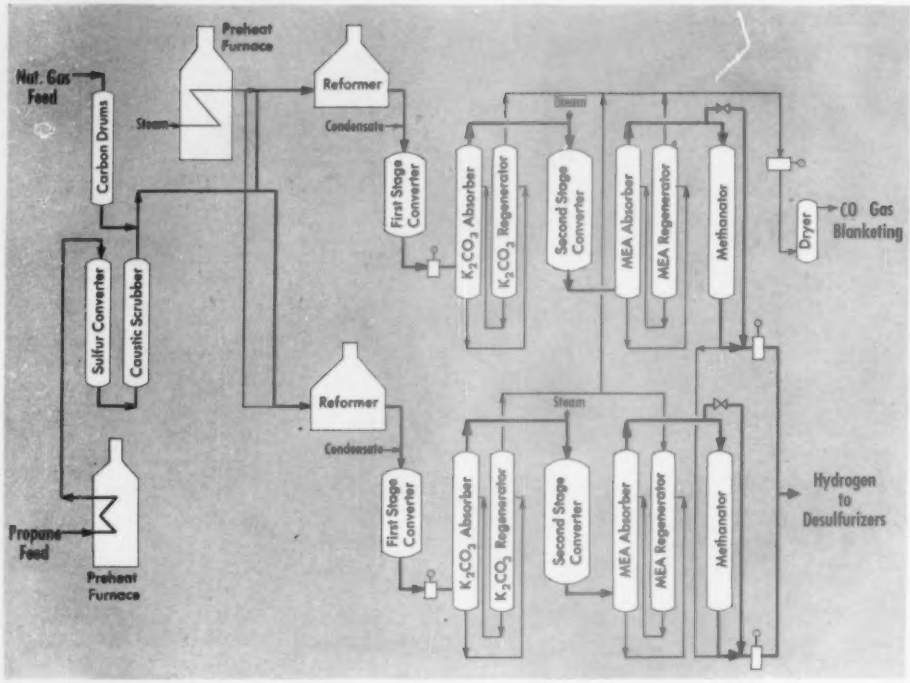




SIMPLIFIED FLOW DIAGRAM of Tidewater's Delaware City hydrogen plant.

tubes was placed in operation, it was noted that deposits were forming on the welds of some tubes. The attack was concentrated around the weld area, thus welding slag was suspected as the cause. This proved to be the case when the furnace was shut down and detailed analyses made.

The situation was corrected by grinding out all of the affected weld and then rewelding. A few tubes, however, were so badly damaged they had to be removed, the weld cut out, rebeveled, and then rewelded. In all cases, the surface was dressed with a grinding wheel after rewelding, after which the weld area was thoroughly sandblasted to remove all traces of slag.

Except for some minor weld splatters which were repaired in a subsequent shutdown about 2 months later, corrosion from weld slag has caused no further problem. All welds in the furnace equipped with Incoloy tubes were thoroughly sandblasted before it was placed in operation.

While dealing with the residual-welding slag problem, Tidewater engineers also noted the corrosive attack was being aided by the high sulfur content of the refinery gases being burned as fuel. An upset in the DEA fuel-gas scrubbing system had resulted in much higher hydrogen sulfide concentrations than the 30 grains per 100 cu. ft. in the flue gas for which the furnace was designed.

This led to changes in the DEA scrubbing system, and to the practice of carefully monitoring the H_2S content of the fuel gas. Natural gas is burned as fuel if the sulfur content of the refinery gases becomes too high. These changes, plus revamping the draft to cells where incomplete combustion was being obtained, are expected to result in a long service life for the tubes.

Other problems. Another trouble point has been in the coolers after the first-stage shift converters. The tremendous heat lost on the first few feet of the tube bundles, plus use of brackish cooling water, results in quite severe waterside corrosion.

No solution has been found, although the original Monel tubes have been replaced with 70-30 copper-nickel tubes. About 3 months' service was obtained with Monel before repairs were needed.

The practice being followed is first to rotate the tube bundle so that relatively new tube surfaces are placed at the hot end of the cooler. After this possibility is exhausted, the next step is to cut off the corroded ends. Using this procedure, about 1 year to 18 months' service is obtained from a bundle.

In the hydrogen-purification section, plugging once was experienced in the carbonate absorber of one train. When the tower was opened, the Raschig-ring packing was found coated with sludge. It was thought that it resulted from chromium reacting with the silica rings, causing them to fuse together and create a high-pressure drop across the tower. The chromium comes from the potassium dichromate added as corrosion inhibitor to the hot-carbonate scrubbing solution. An acid wash corrected the condition.

Since it has been possible to supply sufficient hydrogen with only one unit, the practice has been to switch trains every 6 to 8 months. Before the shutdown train is placed in operation, steam is circulated through the reformer furnace to regenerate the catalyst. During this time, the tube-wall temperatures are held at maximum—about 1,700°—and pressure is reduced to about 30 psig. Thus the original catalyst is still in both furnaces, and there has been no loss in catalyst efficiency noted.

Corrosion by moist carbon dioxide has not been a particular problem, due principally to the use of aluminum and some Monel in critical locations. A dryer removes all traces of moisture from the CO_2 before it is fed into the gas-blanketing system.

Although the high-temperature conditions favor such attacks, periodic inspections have revealed no evidence of hydrogen blistering.

Since it has been possible to operate the plant at only partial capacity, meaningful cost figures have not been developed. Maintenance and turnaround costs are particularly indeterminate. However, it can be said that fuel and utilities account for most of the cost.

HOW TO REDUCE DRILLING COSTS: PART 8

Is all your hydraulic horsepower working for you?

Here are some suggestions for getting full mileage from it

BY PRESTON L. MOORE
University of Oklahoma

IN BOTH hard and soft-rock areas, jet bits, if accompanied by proper bit weight, drill each foot of hole cheaper, in general, than do conventional bits. The exceptions occur where the slush pumps are too small to develop adequate surface horsepower or where the fluid hydraulic program is poorly designed. In these cases the driller can readily produce data which purports to show that jet bits should not be run.

If the pumps are too small for the job, a frequent complaint in some areas, the operator may be stuck with conventional bits regardless of results that show jet bits to be better. This is where the contract cost in dollars per foot breaks down. A contractor who bids $3.50 per foot with miniature pumps may cost the operator more than the contractor bidding $4 per foot with large pumps. You can make a quick check considering how much of total well cost is a function of the per foot drilling rate. Let us examine these costs in more detail:

The operator must pay supervising costs, so that each day the rig remains on the well costs more money.

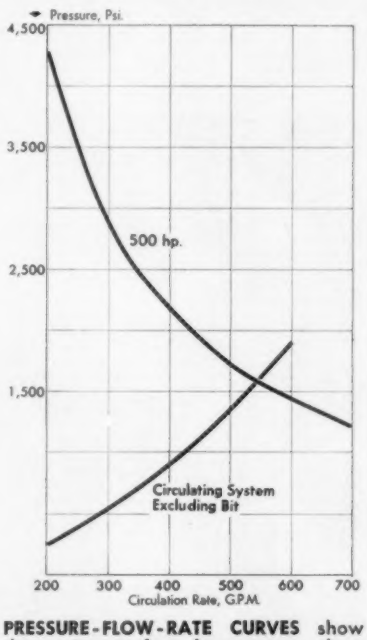
Well trouble may be the operator's responsibility after a given period of trouble.

Mud costs are as much a function of time as anything else and are in most cases the operator's responsibility.

Completion costs may be a function of drilling time and because of extended periods of time in open hole, there may be trouble in running, setting, and cementing casing. Well trouble experienced because of extended drilling time may affect the productivity of a given well, increasing stimulation costs and introducing the possibility of missing a potential pay zone.

These are a few of the additional costs that may arise from staying in the open-hole for an extended period of time. Suppose you save 50 cents per foot in contract cost; this would be $4,000 for an 8,000-ft. well. You could quickly dissipate this amount if you have such trouble during drilling or completion.

Suppose the pumps are adequate. If the horsepower available is not applied properly, the contractor with the large pumps may have no more to offer than the one with small pumps. As a result it is important for the operator to follow the drilling closely even though the contract is let for a given number of dollars per foot.



PRESSURE-FLOW-RATE CURVES show that using surface horsepower alone as criterion has no meaning. Fig. 1.

Thus, you can see that these considerations should be made prior to letting a contract; then, a close check should be maintained during the drilling of the well to be sure that the practices used are designed to drill the well in a minimum number of days. This is not to say that the operator should interfere with the contractor during the drilling of the well; however, the operator is free to express his feelings when the contract is awarded.

How to base program. Accepting the idea that jet bits should be used and assuming the rig has adequate pumps, the primary problem is how to design the hydraulic program. There are several alternatives. The program can be based on: (1) jet-nozzle velocity, (2) bit horsepower, (3) annular fluid velocity, and (4) fluid impact.

In many instances nothing as scientific as these four criteria are used. A jet bit equipped with some given nozzle size is run and the pump is operated at some predetermined level below maximum output. When surface pressure goes beyond a certain level the jet nozzles are increased and drilling progresses. Actually, such a procedure may or may not be using a good hydraulic program.

In general, where programs are designed, the operator or contractor uses either bit horsepower or hydraulic impact as the basis for design. In no case should surface hydraulic horsepower be the only

"Drilling costs are too high to waste any of the power generated."

consideration. To show this, let's first define hydraulic horsepower.

Stated simply hydraulic horsepower is the rate at which work is performed with fluid. It is defined mathematically as being proportional to the volume rate of flow versus pressure. That is:

$$Hp = \frac{PQ}{1714} \qquad (1)$$

where:

P = pressure, psi.
Q = flow rate, g.p.m.
1714 = units conversion constant which changes pressure, psi., and flow rate, g.p.m., to units of horsepower.

Which horsepower? Equation 1 defines **surface** hydraulic horsepower when Ps, the total surface fluid pressure, is used. It defines **bit** horsepower when the fluid pressure drop through the bit nozzles is used. Obviously, with fluid, there will be no change in the volume rate of flow Q in any part of the circulating system.

To show that using surface hydraulic horsepower alone has no meaning, look at the plot of pressure versus flow rate shown in Fig. 1.

Note that, for a given circulating system, it might be possible to use most of the horsepower solely for circulating the fluid. This would leave very little fluid power for use below the bit; the fluid power available has simply been wasted. Drilling costs are too high to waste any power that is generated. Still, in over 75% of the cases where jet bits are used it would be a safe bet that the hydraulic programs could be improved.

Frequently the question arises: How much fluid power is needed below the bit to clean the hole adequately under a given set of conditions? For a well in a known area of drilling, the operator might be able to determine experimentally. Even then, caution would be needed since any change in fluid properties, bit weight, rotary speed, formation characteristics, or any condition of drilling changes power requirements for cleaning below the bit.

Unless conditions are well defined and you know definitely that no additional fluid power at the bit is needed, the safe approach is to use the fluid horsepower available at the surface so that the maximum amount can be put to work at bit and a minimum wasted for circulation purposes.

Difference in bases. Most common approach used in the design of a hydraulic program is that where bit horsepower is used as the basic criteria. Why use bit horsepower? Go back to the definition of horsepower, which states that horsepower is a measured rate of doing work. Thus, if the removal of cuttings below the bit is dependent on the rate at which work is performed by the fluid (and many operators accept this), then this is basis that should be used.

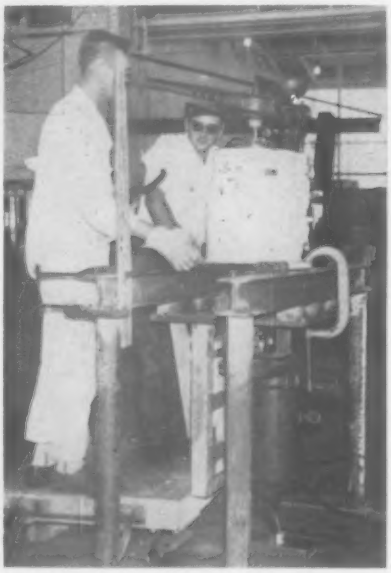
Another frequent approach to design of a hydraulics program is that based on fluid impact. Impact is certainly a function of the amount of hydraulic horsepower available. Yet, it is calculated on an entirely different basis insofar as its application at the bit is concerned.

Fluid impact actually defines the force with which the fluid strikes the bottom of the hole. Thus, it differs from bit horsepower in that the rate of doing work with the fluid is not actually considered. Again there is merit in this approach; it sounds reasonable to use the blasting of cuttings away from bottom as a function fluid force. Companies which use the fluid impact force are convinced that this system of design is superior to that based on bit horsepower.

Both methods of designing hydraulic programs are to be discussed and how they differ will be illustrated in subsequent installments. In many cases an increase in bit hydraulic horsepower might also mean that fluid impact is increased. In others the reverse might be true.

Usually, in design of a hydraulic program based on either bit horsepower or hydraulic impact, there are limiting conditions that must be considered. These include: maximum permissible surface pressure, pressure rating of the pump liners being used, maximum rate of flow possible for the range of liner sizes to be used, annular velocity necessary to lift cuttings out of the hole, and type fluid being used.

The next article will show the theory behind and the application of a hydraulics program based on bit horsepower.



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The rig is used for governors which are removed from power house generators during overhaul.

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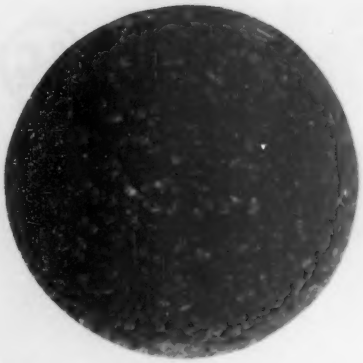


Permeable ball sealers do a better job than

conventional type in

Protecting cement jobs . . .

says S. J. Martinez, Dowell Division of Dow Chemical Co.

HERE'S A NEW TWIST to the ball-sealer method of selective fracturing. Permeable balls!

Made of plastic-consolidated ground walnut shells, these balls were designed to prevent damage to cement during a high-pressure fracture job. They are enough of a plugging agent to divert the flow of most of the fracture fluid and sand into open perforations. But they are permeable enough that there is some pressure equalization behind the pipe, and the cement between perforations doesn't have to withstand all of the fracturing pressure.

Here's the problem. Cement behind the pipe is frequently cracked or broken during the perforation of a productive zone. Then, when a conventional ball sealer is in place on a perforation during a later fracturing job, hydraulic pressure applied through an open perforation imposes a pressure differential across the cement that may approach several thousand pounds per square inch.

If the perforations are too close together, or if the cement has been damaged by perforating, the pressure differential may be enough to cause further damage to the cement, and channeling of the fracture fluid.

The result is that all of the fracture fluid goes into the formation at the point of highest permeability, and the purpose of using the ball sealers in the first place is defeated. The job that was designed to selectively fracture through several sets of perforations in the same well is a failure.

This is often evidenced by failure to obtain a pressure rise in the fracture-fluid stream after the ball sealers are seated in the perforations.

And the solution. The problem has been overcome by the development of a new ball-type diverter, which sold under the Dowell trademark, Channelban.

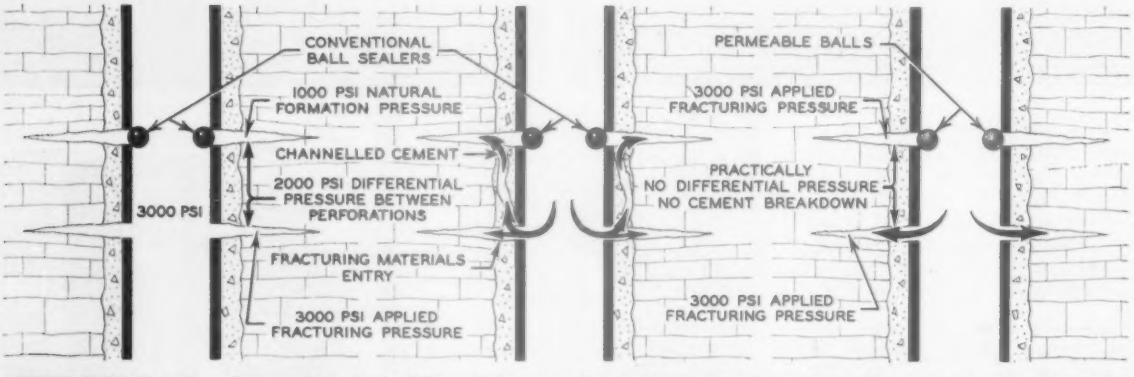
These balls are permeable, allowing restricted fluid flow through them, after they are seated and fracturing pressures are applied. They are finely pored and restrict the passage of sand or other fracture solids. Thus the bulk of the injected fracturing materials are diverted to a new zone, as desired.

Hydraulic pressure applied through the fluid column is transmitted through the permeable balls so that a large pressure differential between the blocked and unblocked perforations is avoided. This protects the cement between them, minimizing the possibility of breakdown and subsequent channeling. At the same time, the flow of fracturing fluid through the permeable ball is limited so that only a small percentage of the total fracturing material is lost into the previously stimulated zone.

The permeable balls used as diverting agents are made of ground and graded walnut shells that have been consolidated with plastic. Residual channels are left open between the individual shell particles, to provide limited passageways for fluid flow.

These permeable balls are resilient enough to seat firmly, even in jagged perforations, allowing the passage of fluid but not of sand. Shown are an old-style solid-ball sealer, and a new-type permeable ball.

Occasionally a well perforation may be oversize so that a ball sealer may be "pumped through" when fracturing pressures are applied. Later, when the well is put on production, this ex-


CONVENTIONAL BALL SEALERS
1000 PSI NATURAL FORMATION PRESSURE
CHANNELLED CEMENT
2000 PSI DIFFERENTIAL PRESSURE BETWEEN PERFORATIONS
3000 PSI
FRACTURING MATERIALS ENTRY
3000 PSI APPLIED FRACTURING PRESSURE
PERMEABLE BALLS
3000 PSI APPLIED FRACTURING PRESSURE
PRACTICALLY NO DIFFERENTIAL PRESSURE NO CEMENT BREAKDOWN
3000 PSI APPLIED FRACTURING PRESSURE

CONVENTIONAL ball sealers result in high differential pressures between adjacent perforations. When these are closely spaced, the cement which may be already cracked or weakened during perforating, can break down, permitting fracturing materials to enter the sealed zone. Permeable balls, in contrast, permit passage of sufficient fluid to transmit pressure, and avoid high differentials between perforations, while diverting the fracturing materials.

truded ball can act as a check valve, plugging off the perforation. An additional advantage of the permeable balls is that, in such a situation, production is not completely shut off, as in the case of the solid-ball sealers.

Case histories. These permeable balls have been used in approximately 100 selective fracturing treatments to date, and from all indications a satisfactory shutoff of the initially fractured sections has been obtained.

As a typical example of the application of these permeable balls, a well in Tanner pool, Gilmer County, West Virginia, was to be completed with a Riverfrac treatment, using fresh water as a fracturing fluid. The well was perforated in the Berea sand, from 2,391 to 2,396 ft. Following a 200-gal. mud acid wash, the formation was broken down at 1,100 psi., and injection of fracturing materials was started at 500 psi. During this stage, 20,000 gal. of water containing 1 lb. per gallon of sand, was injected into the formation. Injection pressures during this stage gradually rose to 1,400 psi.

A second section up the hole, the Big Injun sand, was then perforated in two zones: 1,982-90 ft., and 2,026-40 ft. Then 300 gal. and 35 permeable balls were pumped down the well, and when a pressure rise indicated that the balls had seated properly in the open Berea section, the well was pressured up to 3,000 psi. to break down the Big Injun sand sections. The pressure broke back to 1,600 psi., and an additional 20,000 gal. of water containing 1 lb. per gallon of sand was injected, presumably into the Big Injun sand section. The job was completed successfully, without mechanical difficulty.

Production from this well was increased from a show of oil to 20 bbl. per day and 500 M.c.f. of gas.

Conclusions

It is recognized that these permeable balls are not a cure-all. Under some circumstances they cannot act as a diverting agent. For example, if a vertical fracture connecting all or most of the perforations is naturally present (or created during the initial stage of the fracturing treatment) no type of ball sealer will provide selective control of point of entry. Under these conditions, the fracturing materials are free to move vertically in the formation itself. However, in a formation where horizontal, nonintersecting fractures are formed, it is likely that these permeable balls will provide the desired cement protection and fracturing-treatment control.

BOP protects pumping well during pulling operations

WHEN NECESSARY to pull sucker rods on a well that might flow, a blowout preventer may be screwed into the tubing head above the flowline connection and then an oil saver screwed into this.

A split apron with the split nipple screws into the top of the oil saver so that the rod wrencher is protected from sprays and well fumes.

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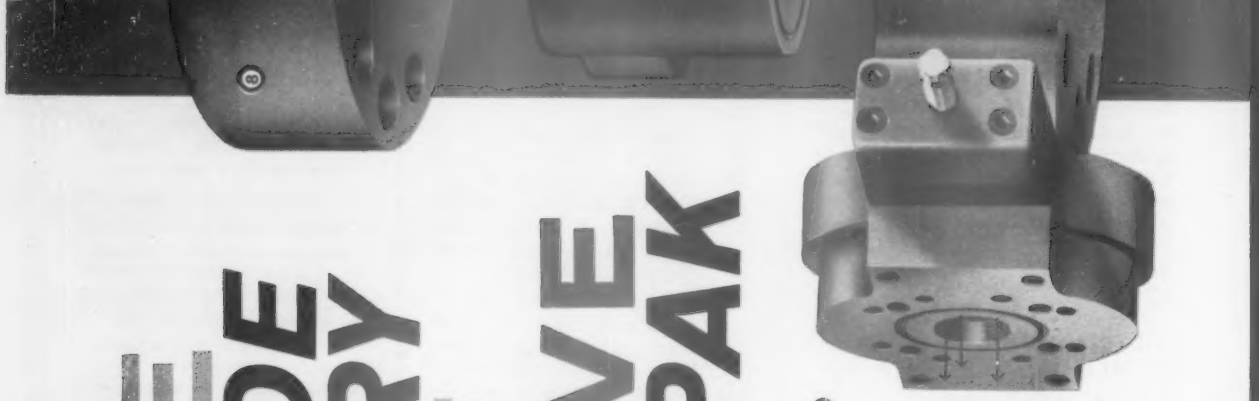

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OIL-WELL PUMPING
PART 29

More on: How to combat gas lock in pumping

BY JOSEPH ZABA

THE PRECEDING installment covered the first of two ways of minimizing the effect of gas on performance of sucker-rod pumps—prevention of entry of gas into the pump. The second method includes ways to reduce evolution of gas within the pump barrel and handle the gas which is present in the pump.

These methods involve changes in the design of conventional pumps, changes in operating practices, and use of a pump especially designed for gas conditions. The latter subject will be considered in one of the following installments, together with discussion of "special" pumps for different well conditions.

Pump design and gas conditions. A sucker-rod pump is, to a certain degree, a compressor. The clearance space and the plunger stroke are the factors which affect the compression ratio of the pump. The clearance space is the volume of the pump between the traveling and the standing valves at the bottom of the stroke. The smaller the clearance space the less gas and oil will be left between the valves at the bottom of the stroke. Less expansion will be needed during the upstroke to bring the pressure within the pump down to the pressure of the submergence with the resulting earlier opening of the standing valve.

The compression ratio is the ratio of the pump volume between the valves at the top of the stroke to the clearance space. The higher this ratio is, the higher the compression of gas within the pump barrel and the less chance of the traveling valve failing to open on the downstroke.

In actual practice, decrease of clearance space is attained by proper spacing of the plunger and by installing the traveling valve in the bottom of the plunger. This places the traveling and the standing valves close together at the bottom of the stroke. This cannot be done in certain types of pumps so some designs, as discussed later, are better adapted to handling gas than others. The compression ratio for any given size of clearance space may be increased by providing a longer stroke or by increasing the diameter of the pump, or both.

Factors which have an important bearing on the evolution of the gas within the pump are the designs of the gas anchor tube and the standing valve. Rapid and turbulent flow through the standing valve is conducive to evolution of dissolved gas. To prevent this, the standing valve should be large and streamlined, so that the flow of fluid into the pump is smooth and slow. In wells having gas trouble, oversized standing valves have proved valuable.

Operating practices for gas conditions. The benefits of increased pump submergence in case of gas interference have been already men-

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main dimensions of the elements which are used in manufacture of the parts. For instance, to quote Standard 11-A" . . . cages herein are not standardized as to length, number, and shape of parts, material, etc. The connecting threads at top and bottom of the cage, including seat recess needed for interchange ability, are covered herein."

Over the years a multitude of different pump assemblies have been developed. Considering variations in the components, there are now commercially available several thousand of possible combinations of makes, types, and sizes of sucker-rod pumps. The rather cumbersome API numbering system is used infrequently. Because of this situation—a burden on both the manufacturers and the users—the subcommittee on pumps of the API committee on standardization of production equipment decided in 1956 that there is a need for an entirely new approach to the problem.

Instead of making changes and additions to Standard 11-A, a program should be developed establishing a number of standard basic pumps composed of parts which would be completely interchangeable among the manufacturers. A new simplified API numbering system should be developed.

A special task group has been formed within the subcommittee to

technological breakthrough for measuring H_2O in H_2

More on: How to combat gas lock in pumping

BY JOSEPH ZABA

THE PRECEDING installment covered the first of two ways of minimizing the effect of gas on performance of sucker-rod pumps—prevention of entry of gas into the pump. The second method includes ways to reduce evolution of gas within the pump barrel and handle the gas which is present in the pump.

These methods involve changes in the design of conventional pumps, changes in operating practices, and use of a pump especially designed for gas conditions. The latter subject will be considered in one of the following installments, together with discussion of "special" pumps for different well conditions.

Pump design and gas conditions. A sucker-rod pump is, to a certain degree, a compressor. The clearance space and the plunger stroke are the factors which affect the compression ratio of the pump. The clearance space is the volume of the pump between the traveling and the standing valves at the bottom of the stroke. The smaller the clearance space the less gas and oil will be left between the valves at the bottom of the stroke. Less expansion will be needed during the upstroke to bring the pressure within the pump down to the pressure of the submergence with the resulting earlier opening of the standing valve.

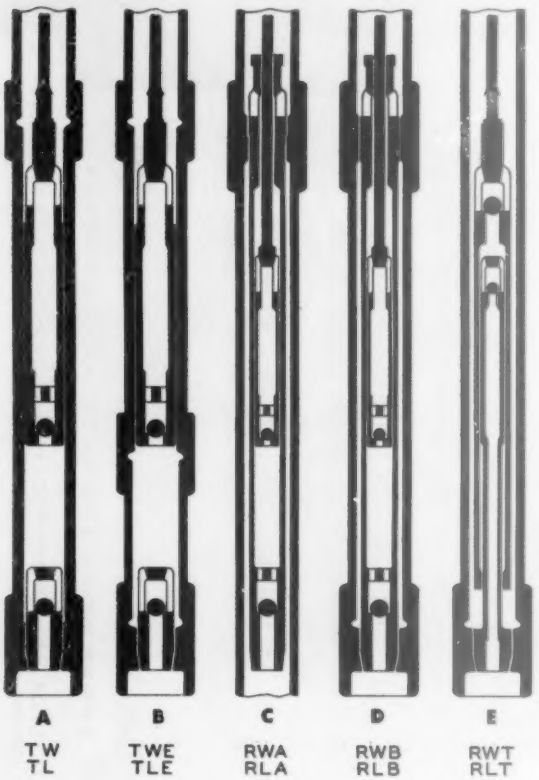
The compression ratio is the ratio of the pump volume between the valves at the top of the stroke to the clearance space. The higher this ratio is, the higher the compression of gas within the pump barrel and the less chance of the traveling valve failing to open on the downstroke.

In actual practice, decrease of clearance space is attained by proper spacing of the plunger and by installing the traveling valve in the bottom of the plunger. This places the traveling and the standing valves close together at the bottom of the stroke. This cannot be done in certain types of pumps so some designs, as discussed later, are better adapted to handling gas than others. The compression ratio for any given size of clearance space may be increased by providing a longer stroke or by increasing the diameter of the pump, or both.

Factors which have an important bearing on the evolution of the gas within the pump are the designs of the gas anchor tube and the standing valve. Rapid and turbulent flow through the standing valve is conducive to evolution of dissolved gas. To prevent this, the standing valve should be large and streamlined, so that the flow of fluid into the pump is smooth and slow. In wells having gas trouble, oversized standing valves have proved valuable.

Operating practices for gas conditions. The benefits of increased pump submergence in case of gas interference have been already mentioned (Part 26). Increasing the stroke length, with clearance space constant, increases the compresion ratio of the pump, as pointed out above. Slow pumping speed permits slow filling up of the pump. However, gas lock may be sometimes broken by a temporary increase in pumping speed. This is because the overtravel of the plunger under the high pumping speed increases the stroke and what follows the compression ratio of the pump.

"Heading" during early stages of the pumping life of some wells may be sometimes controlled by maintaining a back pressure on the pump. This is done by placing a properly sized choke in the flow line.



API PUMP CLASSIFICATIONS. First letter: R—rod type; T—tubing type. **Second letter:** W — full barrel; L—liner barrel, sectional or one piece. **Third letter:** E—tubing type with expansion shoe and nipple; A—stationary barrel, rod type, with top holddown; B—stationary barrel, rod type, with bottom holddown; T — traveling barrel, rod type.

API pump standards. Fig. 35 gives basic pump classification as contained in the API Standard 11-A "API Specification for Oil-Well Pumps."

Standard 11-A uses the so-called "parts elements" system. Dimensions which are used together as a unit in a pump are arranged in groups and are identified by an element letter symbol. Size designation is by a number. Both the letter and the number symbols are a part of the marking system. The specification does not, in most instances, standardize the pump parts as such but it provides the

main dimensions of the elements which are used in manufacture of the parts. For instance, to quote Standard 11-A" . . . cages herein are not standardized as to length, number, and shape of parts, material, etc. The connecting threads at top and bottom of the cage, including seat recess needed for interchange ability, are covered herein."

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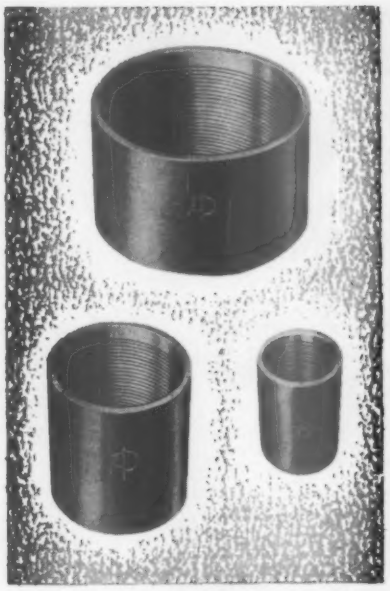
Instead of making changes and additions to Standard 11-A, a program should be developed establishing a number of standard basic pumps composed of parts which would be completely interchangeable among the manufacturers. A new simplified API numbering system should be developed.

A special task group has been formed within the subcommittee to do this. After 3 years of work the task group presented to the subcommittee, in June 1960, a draft of Standard 11-AX: "API Specification for Subsurface Pumps and Fittings." The standard gives specifications for nine basic rod type pumps in four commonly used bore sizes for use in 2⅜ and 2⅞-in. tubing. The standard does not specify details of design and materials. However, the dimensional requirements are such that complete interchangeability is assured. A new numbering system is included.

The final draft of Standard 11-AX is now being voted on by the full membership of the committee on standardization of production equipment. If approved, it will replace Standard 11-A which will remain available as a reference manual. Eighteen months after issuance of Standard 11-AX, API pumps will have to comply with the new specifications.

The next assignment of the task group is to work on standards for 1¼-in. pumps in 1½-in. tubing, 1 and 1 1/16-in. pumps in 1½ and 2-in. tubing and rod pumps for 3-in. tubing. The work of the task group is a significant contribution toward elimination of confusion which existed for years in the field of standardization of sucker-rod pumps.



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▶▶▶ New Equipment Section

This week's SHOWCASE features . . .

Latest flow instruments

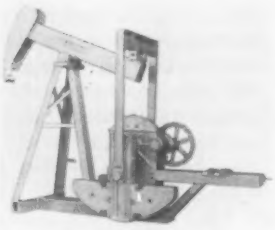
. . . announced are a turbine flowmeter and a flow analyzer. The instruments were originally developed to improve cementing and fracturing services.

The instruments are portable and promise to be useful in a variety of applications in refineries and research departments. Abrasive and other difficult fluids have not affected the flowmeter's accuracy, the maker says.

Working in tandem with the flowmeter, the flow analyzer receives a pulse type of electrical signal from the flowmeter. It then displays flow rate and totalized flow.

The flow analyzer is self-powered. It can be used at locations remote from the meter. Mounted on etched circuit boards, the electric circuits provide a compact unit.

The meter produces an electric signal with a frequency proportional to flow rate. This signal can be transmitted to instruments more than 100 ft. from the meter. The meter is adaptable to direct current or to 3-15 psi. air signals for an external power source. Source: **Halliburton Co., Duncan, Okla., U.S.A.**



Latest oil-well pump jack

. . . to be announced is designed, through the use of bolted construction, to make it easy to convert from an electrical motor mounting to engine mounting. The motor mount is elevated above ground level where it, according to the maker, prolongs motor life and protects the motor from dirt.

Compared with older units, the Hi-Compact rotary-balanced jack is claimed to require less foundation concrete and to use shorter drive belts. The rotary-balance adjustment is a rack-and-pinion system that can be adjusted by one man, standing at ground level, the maker says. Source: **Jensen Bros. Mfg. Co., Inc., Coffeyville, Kans., U.S.A.**

New storage tank developed

. . . for petroleum products. Called a Cylindroid, the tank can be erected in the field to correspond to the size and shape of square or rectangular industrial lots, the maker says.

The new tank design gives about 16% more storage capacity than a

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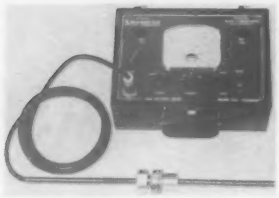
New Equipment

comparable cylindrical tank. According to the maker, the Cylindroid also costs less to build as it makes possible the use of lighter steel, requires relatively less shop forming and prefabrication, and can be erected on the site with a small crew and light equipment. Fitup is straight-line and welding is all downhand. Source: **Graver Tank & Mfg. Co., 4809 Tod Ave., East Chicago, Ind., U.S.A.**



Gas velocity

. . . can be measured with an instrument now on the market called a gas-velocity meter. The meter is claimed to give instantaneous, accurate measurement of the mass velocity of gas flow as it passes through a line.

To obtain a velocity reading, a probe containing a sensing unit is inserted into a line through a 1-in. pipe tap. Velocity is then indicated directly on the meter.

The velocity reading can then be converted into cubic feet per hour from a quick-reference chart that comes with the instrument.

Potential uses include analysis of gas flow in a distribution system. Flow direction is indicated on the instrument by depressing a button.

Completely transistorized, the instrument weighs 10 lb. and operates on a nickel-cadmium rechargeable battery. Source: **American Meter Co., 920 Payne Ave., Erie, Pa., U.S.A.**

•

Explosive jar

. . . for 2-in. tubing or larger hits a blow many times harder than a rein jar, the maker says. The Kinley explosive jar, according to the maker, will knock a stuck choke loose, put a hole through a bull plug, or take a deep impression with an impression block.

As described by the maker, the jar strikes downwardly with an explosive force which drives a hammer. The force of the explosion is entirely contained within the tool, which can be used again immediately after reloading. Source: **J. C. Kinley Co., 5815 Royalton, Houston 36, Tex., U.S.A.**

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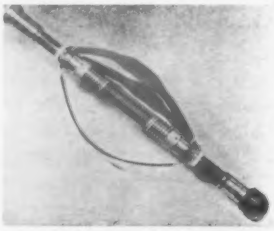

New combination well log

. . . consists of a sonic log combined with a caliper log into one simultaneously recorded operation. The combination log promises to increase logging efficiency and lower costs.

Potential uses are numerous. The caliper log is valued as an aid to interpretation of the sonic log. When

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viewed together with the sonic or other open-hole logs, it helps to identify formations that are permeable. Thus simultaneous recording of the two logs on the same film facilitates log interpretation. Source: **Schlumberger Well Surveying Corp., P. O. Box 2175, Houston, Tex., U.S.A.**

●

Centerline-mounted pump

. . . is available that the maker says is capable of handling virtually all liquids used in refining and petrochemical manufacture. The DMR pump is so designed that a "tailor-made" pump can be assembled from off-the-shelf components, the maker claims.

The pump has a capacity of 900 g.p.m., heads up to 450 ft., temperatures up to 450° F., and working pressures up to 300 psig. Basically, it is a single-stage, horizontal, end-suction, top-discharge type of pump. It comes in 1, 2, and 3-in. discharge sizes, on an 8½-in. frame and 1, 2, 3, and 4-in. sizes on a 10½-in. frame. Source: **Peerless Pump, Hydrodynamics Div., Food Machinery and Chemical Corp., 301 W. Ave. 26, Los Angeles 31, Calif., U.S.A.**

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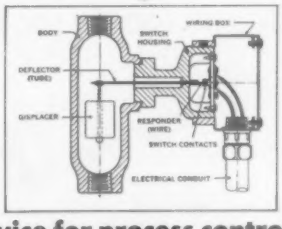

Device for process control

. . . has been announced which uses a wire-in-tube element for transmitting motion through a pressure-tight wall without bellows, seals, or stuffing boxes. The device is expected to prove useful for both detection and control of process variables.

Potential uses for the element include indication or control of level, flow, density, or temperature in process tanks, piping, and reactors. Source: **Yarnall-Waring Co., 102 E. Mermaid Lane, Philadelphia 18, Pa., U.S.A.**

Actuator handles most valves

. . . of any type or size, according to the maker of this hydraulic valve actuator. The complete unit includes these eight items: motor, pump, coupling, integral reservoir, pressure switch, hand pump, gages, and any required safety devices. The actuator is designed to be compact and take up little space through miniaturization of components and doing away with external valving.

The motor and pump run only for the few seconds required to open or close a valve. Any automatic locking feature is incorporated in the design. It holds the gate or plug in the desired position almost indefinitely, the maker says. An internally mounted directional valve controls the automatic locking feature. Source: **Oil-Dyne, Inc., 2119L W. Marquette Rd., Chicago 36, Ill., U.S.A.**

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116 Oil Wells (West Texas). 2 casing leaks had resulted from external corrosion in this field. CSI ran current requirement tests, then installed rectifiers and graphite anodes on each well. Cost was only $300 to $350 per well.

Pipe Line (Southern Oklahoma). This line is operated by a major company. A cathodic protection system using 15 rectifiers was installed. CSI furnished all materials, labor, 15-foot augers, ditchers and other necessary equipment.

30 Oil Wells (Western Kansas). CSI determined current needed to stop corrosion; then installed 6-ampere-output rectifiers on a turnkey basis. Cost: $300-$350 per well.

Housing Unit Piping (Ohio). The builder of this housing unit wanted to prevent leaks and lengthen the life of the underground piping system. CSI recommended and installed a protective system using magnesium anodes. Anodes were used to lessen stray-current danger to nearby structures.

29 Oil Wells (West Texas). One casing leak had already occurred in this field. CSI installed protective systems using special new rectifiers that deliver almost constant current output despite heavy rains or dry periods.

Pipe Line (West Texas). Experience indicated that leaks would become an increasing problem. Protection was required. CSI installed 600 magnesium anodes in only 10 days.

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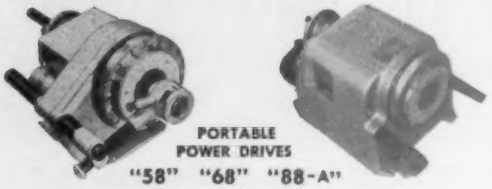

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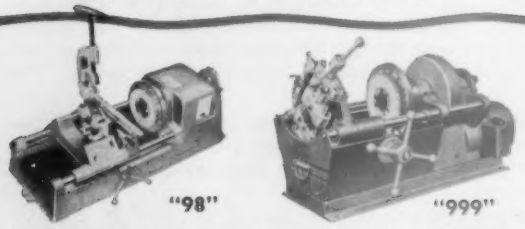

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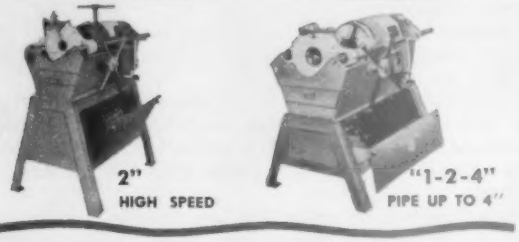

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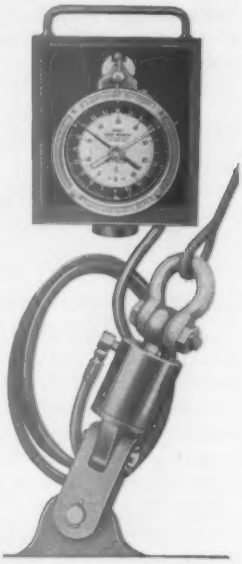

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SHOWCASE . . .

New Literature

Water-conditioning data sheet

. . . entitled "Pretreatment for Effective Corrosion Control," discusses how rapid film formation by pretreatment can improve cooling-water corrosion control. Source: **Betz Laboratories, Inc., Gillingham and Worth Sts., Philadelphia 24, Pa., U.S.A.**

Selecting hose style

. . . for virtually every industrial application is described in a new guide. Listed are 112 separate liquids and gases, beginning alphabetically with acetate solvents and ending with zinc-salt solutions. The suitability of various hose tubestocks for use in carrying these agents is charted in four separate classifications: excellent, good, conditional, and unsatisfactory. The charts indicate tubestock suitability only; a separate chart provides basic data on the pressure, temperature, and size limits of individual hose types. Source: **Aeroquip Corp., Jackson, Mich., U.S.A.**

Tires for off-highway travel

. . . are featured in a new six-page pamphlet obtainable for the asking. Called the Hi-Flotation T-kit, the wheel kits are interchangeable with regular wheels. According to the literature, the T-kit permits the owner of virtually any vehicle to travel off-highway over sand, snow, tundra, and other soft unstable soil conditions which might easily defeat the conventionally equipped vehicle. Source: **Terra Engineering Co., Inc., 271 Figueroa, Monterey, Calif., U.S.A.**

Continuous-weld seamless pipe

. . . known as "Yoloy" is the topic of an eight-page, file-size brochure which offers data on the corrosion-resistant qualities and physical features of the steel pipe. Yoloy's resistance to atmospheric, soil, and chemical corrosion is illustrated in charts and graphs that compare the pipe to carbon steel and wrought iron. Other charts compare tensile, yield, and impact strengths. Source: **Youngstown Sheet & Tube Co., Box 900, Youngstown, Ohio, U.S.A.**

High-temperature-alloys

. . . booklet compares 17 alloys against each other in the areas of physical, mechanical, and chemical properties, and stress-rupture data. Easily interpreted charts show selected properties for each alloy at specific temperatures. The 20-page booklet offers data covering the alloys in various forms. Source: **Haynes Stellite Co., 270 Park Ave., New York 17, N. Y., U.S.A.**

Sand-control information

. . . is available in a new prepacked screen and general oil-field catalog. Information lists technical data, setting procedures, prices, and descriptions. The publication offers seven different sizes including the new "Slim Hole" prepack designed for conventional or wire-line operations inside 2⅞-in. o.d. tubing. Source: **Double Seal Co., Box 14452, Houston 21, Tex., U.S.A.**

Industrial-telemetering

. . . volume is the first in a series of publications devoted to a simplified

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MACCO NORMALLY CLOSED CHECK VALVES

The Dual-Seat: This normally closed 5000# W.P. Macco check valve is dual seating—first, a metal shoulder on a "resinoid" disc and also metal-to-metal under high pressure.

Installed on a Macco gas lift valve, this check valve positively prevents back flow of fluid from the tubing to the casing. It is also possible to acidize the formation or back-pressure the tubing without exposing the casing to either acid or extreme pressures. A scientifically designed hollow "float" allows all of the gas or fluid which passes through the check valve to pass through the lateral openings and hollow stem. This feature, a patented design, provides protection for the spring and makes it particularly resistant to the ill effects of abrasive erosion.

The Triple-Seal: Another "First" by Macco, this outstanding check has the dual seat float plus an O-ring tip to give *extra insurance* against even the most minute passage of fluid, gas or sand.

The Auxiliary: Again a "First," this Macco check is another major development in gas lift equipment evolution. It is used as an auxiliary with a regular check in multiple completions where mud cake may jam balls of gravity, magnetic or velocity checks during the long waiting periods. In this check, a squeeze-proof resilient sleeve seals on a perforated inner core.

Write for Check Valve Brochure.

MACCO — TIME TESTED — PRODUCTION EQUIPMENT

MACCO OIL TOOL COMPANY, INC.

1521 Prince **P. O. Box 7288** **Houston 8, Texas**

Phone UN 1-1253

MACCO equipment is also available in sterling areas from Williams & James (Oil Tools) Ltd., Gloucester, England.

explanation of industrial telemetering. Starting with the ABC's of land line codes, parity checks, and weighted binary techniques, the series will continue through an entire exposition of supervisory control and telemetering. Source: **Control Div., Dresser Electronics, Box 22187, Houston 27, Tex., U.S.A.**

Packed-column support plates

. . . distributors, and holddown plates are detailed in new 32-page Manual TA-40. It discusses such problems as height of packing above support plates, methods of redistribution, how to install support plates, and where "holddown" plates are desirable. The publication also shows average flow in gallons per minute for different types of distributors. Source: **U. S. Stoneware Co., 5300 E. Tallmadge Ave., Akron 9, Ohio, U.S.A.**

Forged-steel casing

. . . and tubing heads are detailed in a new eight-page bulletin, free upon request. It features technical descriptions, dimensions and parts charts, and schematic drawings of forged-steel casing and tubing heads. The bulletin includes application data and illustrations of christmas-tree assemblies with typical combinations of O-C-T independent (low-pressure) casing and tubing heads. Source: **Oil Center Tool Co., Box 3091, Houston, Tex., U.S.A.**

New pump-valve spacer

. . . said to simplify bumping bottom or spacing subsurface-pump valves, is featured in a two-page literature piece now obtainable. Replacing conventional carrier bars on unit pumpers, the valve spacers are available in two models, each with a 12 or 18-in. vertical-adjustment screw. The bulletin contains application data. Source: **Continental-Emsco Co., Box 359, Dallas 21, Tex., U.S.A.**

Latest digital computer

. . . a general-purpose type called the pb250, is described in a new six-page brochure just published. The command repertoire and complete specifications are included. Source: **Packard Bell Computer Corp., 1905-1907 Armacost Ave., Los Angeles 25, Calif., U.S.A.**

▶▶▶ Equipment Men Notes

Frank L. Williams is vice prexy ... and sales manager of Waukesha Sales & Service, Inc., announces L. M. Pearce, Jr., president. Williams has been with the Houston company the past 14 years. Waukesha Sales & Service is distributor for Waukesha, Climax, and Kohler engines throughout Texas and parts of Louisiana, New Mexico, and Arkansas.

F. L. Williams

Bolling A. Abercrombie promoted ... to manager of product planning for Axelson-Garrett Division of U. S. Industries, Inc. In this post he will be responsible for locating and developing new products and coordinating the research and development program of the division. He will headquarter at the Longview, Tex., office.

Abercrombie has worked as a sales engineer, administrative engineer, and most recently, as the engineering department's manager of product planning and evaluation for Axelson-Garrett and its predecessors since 1955.

William E. Lennard becomes ... city representative of U. S. Steel Corp.'s Oil Well Supply Division in Los Angeles, announces D. S. Grubbs, manager of the division's California area. Lennard was employed by Oilwell in 1948 as assistant district engineer at Los Angeles.

He was appointed district engineer at that location in 1949, transferring to Long Beach the next year, and back to Los Angeles in 1953 as assistant to the area engineer. Lennard was named manager of drilling-equipment sales in 1959, holding this position in Los Angeles until now.

Graver Tank & Mfg. Co. names ... Alan Law and R. W. Briska to positions in the company's newly established industrial engineering department, and promotes E. G. Vail to plant manager at Houston.

Law, who will head the department as chief industrial engineer, previously was plant manager at Houston. He originally joined Graver as an industrial engineer, and will report directly to Ivan Smith, East Chicago plant manager.

Under the new concept, the function of plant engineering will be incorporated with industrial engineering and will come under the direction of Briska, newly appointed plant manager. His group will report directly to Law. Vail in turn takes Law's place in Houston.

Clark P. Lattin, Jr. is elected ... vice president in charge of petroleum and petrochemical development for Chemical Construction Corp. Until his recent resignation, he was a vice president, member of the board of directors, and member of the executive committee of Foster Wheeler Corp. Chemico is the wholly owned chemical-process-engineering and construction subsidiary of Electric Bond & Share Co.

Lucey Products Corp. appoints

... John A. Daugherty as vice president, in which position he will direct activities toward development of the company's Gulf Coast program in the production and drilling branches of the industry. He will locate in Houston.

Daugherty began his career in Houston with National Supply Co. in 1920, where he remained until joining Mid-Continent Supply Co. in 1933. He served Mid-Continent at Tulsa as vice president from 1935 until 1947, when he was elected director and returned to Houston. He held that post until resigning last month.

New plant built in Longview, Tex. ... by Cherokee-Joy, fabricator of gas and air-drilling compressors, formerly with Cherokee Steel, Inc., of Tulsa. M. C. Bolin, Jr., who has directed the business at Cherokee Steel for several years, continues to do so as president of the new company, Cherco Equipment, Inc. All Cherokee - Joy engineers and a large part of the production staff remain with Bolin's new organization. The new plant also includes Garzo, Inc., manufacturers of patented automatic lubricators and other accessories for use on internal combustion.

The principal owner of both companies now is Cherokee Laboratories, Inc., which has expanded its own operations to the Longview offices. Cherokee Laboratories' field staff throughout the United States and Canada oil and gas fields is intended to complement the engineering and sales operations of Cherco and Garzo.

Continental-Emsco Co. makes ... a series of changes in its organizational alignment. Leroy E. Fullingim, former store manager, is now district D+B specialist at the company's Houston district and is headquartered at Houston. Billie L. Lewey, former D+B specialist, has been promoted to store manager at Luling, Tex. Also promoted to store manager is James E. Cooper, Tatum, N. M. Cooper was formerly a field salesman.

Ronald M. Young, former D+B specialist trainee, is now a D+B specialist at Daisetta, Tex. R. H. Trimble has been hired as a D+B specialist at El Dorado, Ark. Two C-E employes have been changed to different locations: Thomas A. Mann, division sucker-rod specialist, has moved from Oklahoma City to Tulsa; and Miller F. Moffett, D+B specialist, has moved from Alice, Tex., to Daisetta.

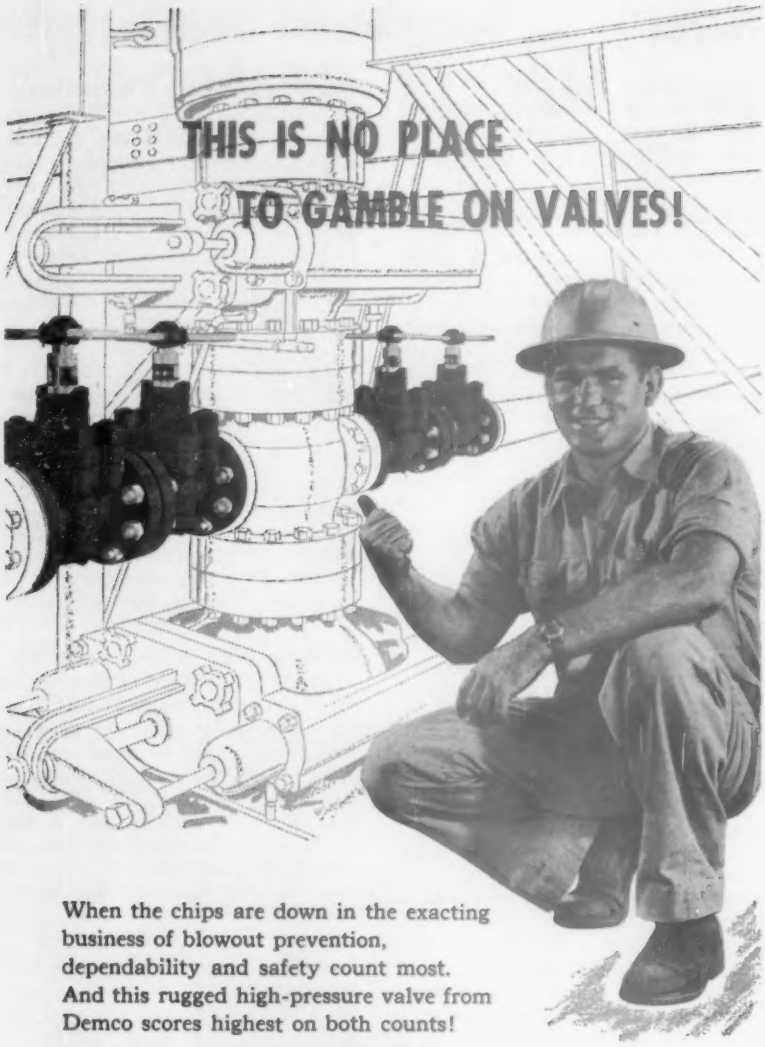
Maddox joins Allied Materials ... in Oklahoma City as manager of the corporation's newly formed Pipeline Coating & Materials Division. Max Maddox goes to Allied from 14 years' experience in the pipeline industry and related fields. His work has been with coal tar and asphalt pipeline coatings, epoxy and internal coatings, and the sales and service of pipeline wrap materials and equipment.

Stanley G. Stroud assumes post

... of coordinator-logging for McCullough Tool Co., his duties to include the coordination and integration of logging methods and techniques on a company - wide basis. He will headquarter at the Los Angeles general office. Previously senior research engineer, Stroud has been with McCullough for 13 years.

General Electric Co. delivers ... an 825-hp. Model 722 industrial gas turbine to Trunkline Gas Co. for use as an experimental compressor driver at a pipeline pumping station near Houston. The project is a part of a larger gas-turbine-testing and evaluation program being conducted by Trunkline.

Under terms of an agreement, Trunkline will test the engine for one year as compressor power source at its Cypress pumping station. The Houston firm pumps natural gas from



When the chips are down in the exacting business of blowout prevention, dependability and safety count most. And this rugged high-pressure valve from Demco scores highest on both counts!

The rugged construction of the Demco Valve assures its reliability—it *holds every time* against the high pressures of an unexpected flow. You get a positive rubber-to-metal seal without applying undue torque to the stem—a drop-tight seal that you can depend on.

And no matter when you need it, the Demco valve will always operate easier. Fewer parts are subject to wear. Stem threads are constantly self-lubricated and are protected from abrasives with *double* stem seal.

When you choose a valve for blowout prevention application, choose reliability, rugged construction and sure-seal safety. Choose Demco!

Available at supply stores everywhere in 1,000, 2,000, 3,000 and 5,000 psi working pressures . . . in two- to four-inch sizes.

DRILLING EQUIPMENT MANUFACTURING CO.

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southern Gulf coastal fields to a junction in Illinois. Panhandle Eastern Pipeline Co., Trunkline's parent firm, then pipes it to the greater Detroit area.

A. J. Foster named to supervise

. . . parts sales for Clark Bros. Co. in the Dallas-Midland district. Locating in Albuquerque, N. M., he will supervise spare-parts sales to the oil, gas, and petrochemical industries in West Texas, New Mexico, and portions of Arizona, Colorado, Wyoming, Idaho, and Utah.

Foster joined the Clark organization in 1948. Prior to this assignment, he worked in the service department both at the Clark plant in Olean, N. Y., and in various field assignments.

National Supply Co. appoints

. . . Lester A. Carlson, Jr., as sales manager of production equipment, succeeding Gerald R. Bond, who has been transferred to the Fluid Packer Pump Co. division.

Carlson, who will continue to locate in Pittsburgh, joined National Supply in 1956 as a sales engineer for the industrial sales department. Previously he was general sales manager of the Industrial Productions Division of Westinghouse Air Brake Co. Bond started with National at Casper, Wyo., in 1950, and later spent 2 years in Denver as sales representative on production equipment. He was appointed sales manager of production equipment in 1956. Bond will reside in Dallas.

Pipe Line Service Corp. begins

. . . construction of a steel pipe coating and wrapping plant in Youngstown, Ohio. The 94,000-sq.-ft. facility, the eighth such plant to be operated by the company, is expected to be completed in April 1961.

Initially the plant will employ about 50 people and will have a pipe-coating capacity of about 1,500 carloads annually. The plant will be located on a 39-acre site to provide storage area for customer pipe en route from steel mills to installation sites.

Meanwhile, Pipe Line Service and Republic Steel Corp. have signed a license agreement whereby Pipe Line Service will extrude plastic coatings for steel pipe used for oil and gas transmission and distribution.

Armco Steel Corp. plans to build

. . . a modern combination pipe mill at the Ambridge, Pa., plant of National Supply Co., an Armco subsidiary. Designed primarily to produce continuous-weld and electric-weld steel pipe, the new mill will also be used to stretch-reduce seamless pipe to smaller sizes.

The multi-million-dollar addition will consolidate National Supply's welded-steel pipe, seamless pipe, and electrical-conduit operations in one plant.

Cabot Corp. elects R. A. Baker

. . . vice president of the corporation. He was vice president and manager of Cabot Shops, Inc., at the time it became part of the corporation. Joining Cabot in 1935 as an engineer, Baker was advanced to chief engineer. In 1941 he became general manager of Cabot Shops, Inc., and in 1951 was made a vice president.

B. W. Rogers becomes manager

. . . of the South Louisiana district for Pipe Inspectors Division of Plastic Applicators, Inc., Houston. Formerly a sales representative for Pipe Inspectors Division at Harvey, La., he will make Lafayette his headquarters. Rogers, who has been associated with the oil-field-supply field since 1950, joined Pipe Inspectors in 1959.

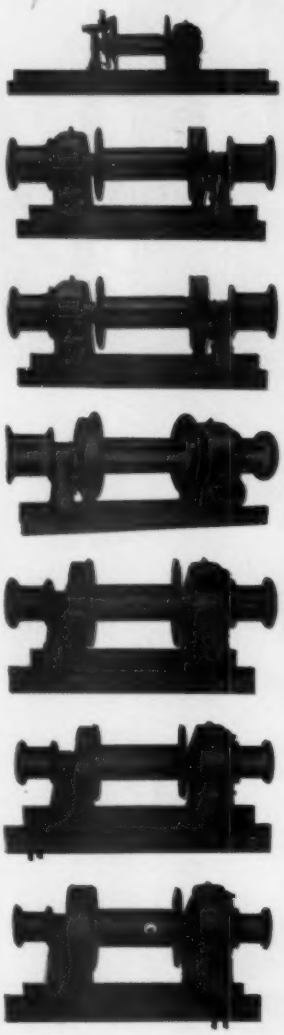
Homco adds four salesmen

. . . to its staff in widely scattered sections of the U. S. Assigned to division offices in Casper is A. F. Criger, who will devote efforts to the rental division of Houston Oil Field Material Co., Inc.

Jack C. Lattimore, assigned to the Tulsa office, has had oil-field experience dating back to 1941. He has been active in the sales field in the Oklahoma-Kansas area for some time and, prior to joining Homco, operated his own business. Assigned to Denver is Rowland D. Young, whose experience embraces roles as a roustabout, tool pusher, drilling superintendent, drilling contractor, and business-management consultant.

Richard D. Arnold has been assigned to New Orleans. He previously was with Humble Oil & Refining Co. as a laboratory assistant in paleontology. Other experience includes posts with Komp Co. as a salesman and with Elgen Corp., dealing in electronic equipment.

Check these **BRADEN** models
for your truck winch needs



MS3 SERIES Particularly well adapted for use on all light duty jobs handling loads up to 8,000 pounds. For behind cab mounting.

MS6 SERIES Rugged models rated at 15,000 pounds capacity. Equipped with Braden's special Oil Cooled, Fully Adjustable Automatic Safety Brake.

MS9 SERIES These models, rated at 20,000 pounds, are among the most popular winches in America. They are designed for low speeds, so are ideal for heavy handling jobs that require perfect load control.

MS12 SERIES The smallest of the Braden heavy duty models with a 30,000 pound capacity. They are especially adaptable for commercial elevator hoists and heavy duty trucking.

MS18 SERIES Very similar to the MS12 models except capacity is 45,000 pounds. The Braden Oil Cooled, Fully Adjustable Automatic Safety Brake is standard equipment on this series.

MS30 -20B SERIES A big baby designed for use on 2½ to 5 ton trucks. It has a rated capacity of 60,000 pounds, and has smooth, steady pulling power with stamina to spare.

MS50 -20B SERIES Here is the greatest capacity truck winch ever built on a production line. It has been tested to handle loads up to 100,000 pounds, and is designed to work perfectly on trucks of 5 tons or more.

Above are a few of the many BRADEN Truck Winches available from stock. In addition you may select underslung front end models, friction clutch winches, extended double drum units, as well as many varieties of custom designed models for special handling jobs. Write for complete information.

BRADEN Winches **WINCH** DIVISION OF MOTOR PRODUCTS CORPORATION

P. O. BOX 547 • BROKEN ARROW, OKLAHOMA

"In Service Around the World"

Bethlehem Wire Rope on 6,500-ft well in Central Oklahoma. At the time of the photograph, this exploratory well near Slaughterville, Oklahoma, was 6,500-ft deep, and drilling still was going strong. The operator, E. L. Oliver Drilling Company, reported outstanding service from Bethlehem 1 ⅛-in. Wire Rope—6 x 19 Form-Set, improved plow steel, with IWRC. Bethlehem Wire Rope is a quality rope in every way. That's why it enjoys a fine reputation for dependability in racking up the ton-miles.

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There's a distributor of Bethlehem Rope near you, supplied by our nationwide network of wire rope mill depots.

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BETHLEHEM STEEL

BETHLEHEM STEEL
BETHLEHEM WIRE ROPE

Gas finds such as this still yield to

Cable-tool drilling in West Virginia

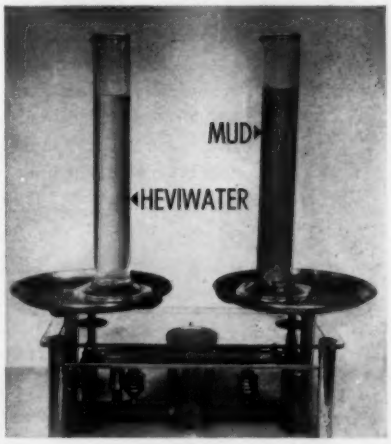
THE CABLE TOOL still reigns as king in West Virginia drilling. In this operation, the Mississippian-Greenbriar limestone yielded 17.2 M.M.c.f.d. natural flow and the rock pressure was 408 psi. Venture is in southern Logan County in the southwest portion of West Virginia about 42 miles southwest of Charleston. The well is Durlinda-Leigh Drilling Co. et al. 1 Durlinda. Partners in the operation include Allegheny Drilling Corp., Russell Perry, Daniel D. Dahill, and A. C. Wilhelm. Tests in the area vary between 2,000 and 5,200 ft. and the operators have two other wells drilling in the vicinity.

California drilling may mark third straight record year

DON'T BE SURPRISED if the total number of completions in California makes a gain for the third straight year in a row. The figures aren't all in yet but it appears that drilling is on the upswing. It won't be a bonanza year by any means, but all signs point to a steady increase.

The gas belt is one reason why

HEVIWATER
completion fluid
avoids use of mud
above packers



Heviwater* completion fluid is a solution of fresh water, calcium chloride, suitable corrosion inhibitors, and zinc chloride if fluid weights above 11.8 pounds per gallon are desired.

Since Heviwater is free of solids, it helps operators avoid problems such as pay contamination and the sticking of packers due to the settling out of solids.

Pre-mixed Heviwater saves rig time. In some cases, a full day of mixing time can be saved by using Heviwater.

Heviwater is pre-mixed to customer specifications at Berwick, Louisiana. With proper notice, Heviwater can be made available wherever this type of completion fluid is needed. Ask your Dowell representative for full information. *DOWELL TRADEMARK

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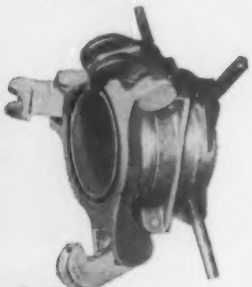
Accurately measures the liquid contents of any container—fast and safely. Mounted top or bottom, this indicator remains hermetically sealed. Just read the extended calibrated rod as it "pops" out of the sealed container.



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Golden State operators are staking their claims for the coming year. At least two new oil fields and 14 gas pools were found during 1960 in northern California in the gas belt.

One operator, Reserve Oil & Gas Co., announced that it found a new gas field at its Liberty Island-Reynolds 2 well. At 4,725 ft. the hole tested 4 M.M.c.f.d. and two other intervals remain to be tested. The well is in 19-5n-3e, Solano County.

The effort was Reserve's second attempt for production in the area, between Maine Prairie and Rio Vista gas fields and near Liberty Cut field. The new strike gives Solano its third for the year. Of note was the Bunker field brought in by Kadane & Sons earlier and confirmed by Amerada Petroleum Corp. with an extension.

Further bolstering the California position are the new gas trunk lines coming into the state from West Texas, New Mexico, and Wyoming. A line is also being built from Alberta to California.

The crude-oil picture is shaping up, too. Not only have there been an increase of cracking facilities to handle the heavier grades of crude, but at least 300 shallow wells drilled less than 1,200 ft. have tried to step up heavy-fraction production. In Kern River field, Tidewater Oil Co. drilled 200 shallow wells and set bottom-hole heaters on the pumpers to increase the flow.

Other focal points of activity are seen at South Belridge where Mobil Oil Co. drilled 25 wells. Shell Oil Co. drilled nearly 50 wells at Coalinga and at San Ardo almost 20 wells were drilled to 2,100 ft. by Texaco Inc. and Mobil.

The need for more pipeline facilities for gas will help ease the pressure on some of the operators with shut-in wells. An estimated 100 gas wells are currently shut in awaiting outlets. At an outlay of approximately $70,000 each, this represents a tidy sum.

Until the actual figures are all in, it won't be known just how California did fare in 1960, as far as percentage increase in drilling went. One thing is certain, things are looking up even if they have a long way to go before they approach a peak year. Nevertheless, things are moving in the right direction.

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SAUDER econo-pak

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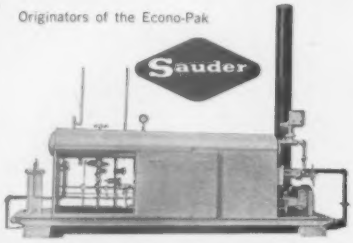
Originators of the Econo-Pak



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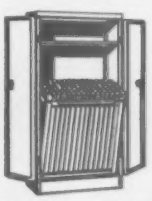
MAP  FILE

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THE EYES OF THE OIL INDUSTRY

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You'll find that the rest of this Chevy for '61 makes every bit as good sense as the trunk. Those easier-to-get-into door openings, for instance, that are as much as half a foot wider. The higher, more comfortable seats. And the extra leg room in the front—plus greater foot room in the back. These are just a few of the many built-for-business benefits that will help you get more out of your Chevy from the time you buy it till the day you trade it in. See your dealer soon for all the details. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

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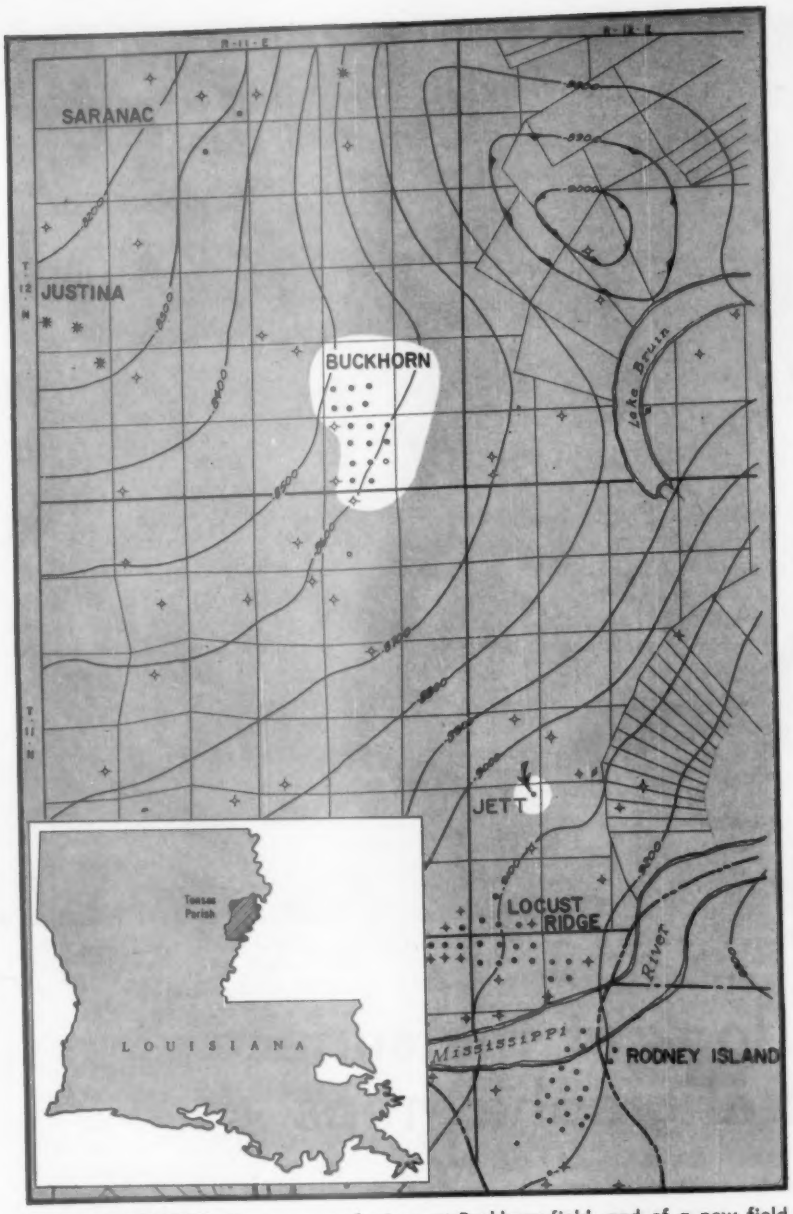


RECENT DISCOVERY of a new pay horizon at Buckhorn field, and of a new field at Jett Drilling Co., Inc., 1 Anderson (arrow) have thrust Tensas Parish, Louisiana, into an active exploratory play. (Map and many of the data for this article provided by Roy Benke, consulting geologist, Jackson, Miss., contours on basal Tuscaloosa sand.)

North Louisiana drillers find luck in Tensas Parish

BY FRANK J. GARDNER

THE UNIMPORTANCE of old dry holes was amply demonstrated the past month in Tensas Parish, Louisiana. Failures to the north, south, and east of the drill site didn't deter Jett Drilling Co., Inc., from sinking its 1 Tensas Burial & Benefit Association in Section 45-11n-12e. And it came in as one of North Louisiana's better discoveries of 1960.

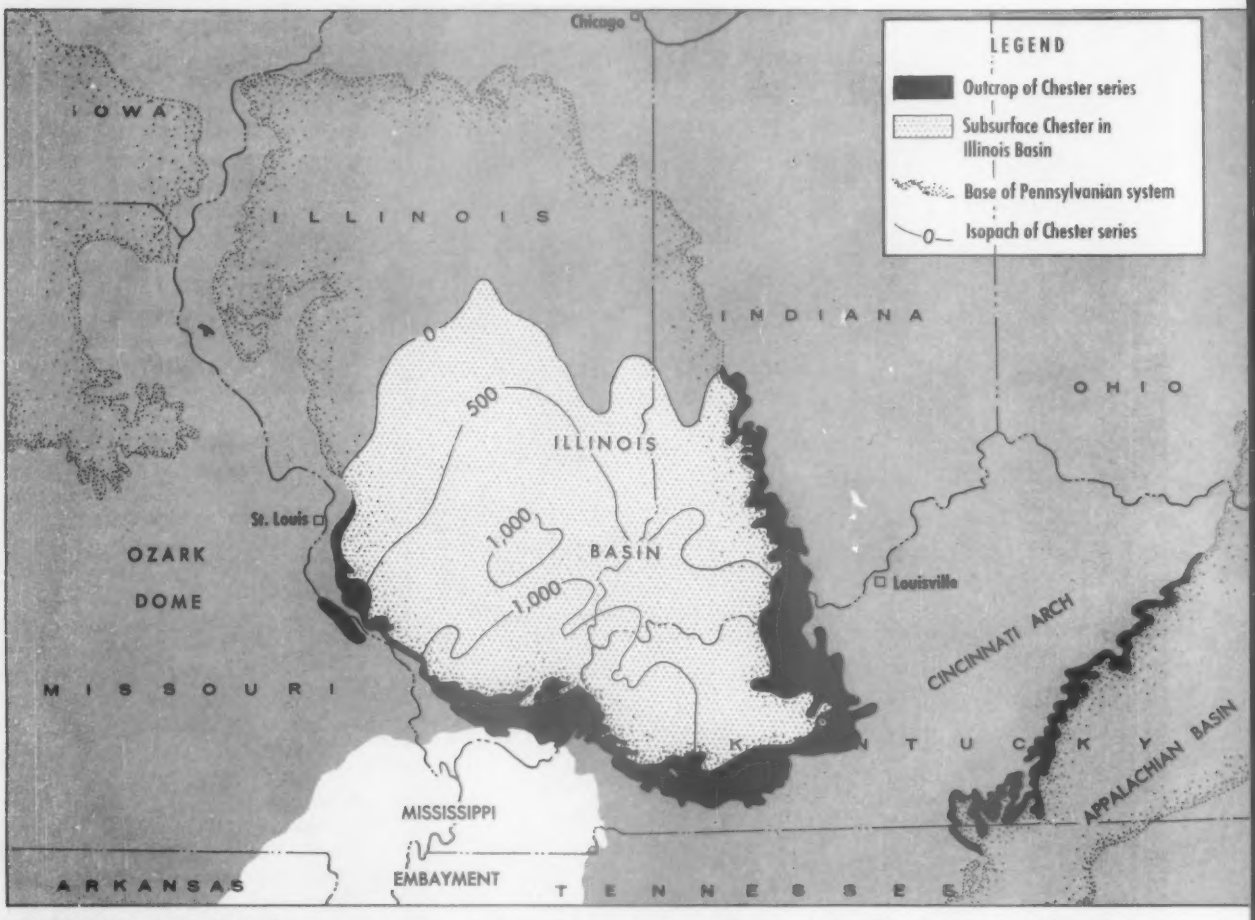
The discovery flowed 184 bbl. per day on 9/64-in. choke from Lower Tuscaloosa - Cretaceous perforations at 9,129-39 ft. Total depth was 9,207 ft. Its success underscored the growing importance of Tensas Parish as an oil producer, and should draw new exploratory effort there.

The Jett discovery is just one facet of Tensas activity. An even more interesting one has been shaping up 5 miles northwest of the new strike. Here, at Buckhorn field, a late-1959 discovery, a new producing horizon of unsuspected importance has evolved. Lying in Sections 26 and 35-12n-11e, Buckhorn now has 16 wells producing from the "Buckhorn" sand, which is post-Lower Cretaceous and pre - Tuscaloosa in age.

The discovery well, La Grange Petroleum Co. and Estate of Wm. G. Helis 1 Anderson, was drilled in December 1959. It found the basal Tuscaloosa saturated with gas-condensate and oil at 8,614-67 ft.; this is the producing reservoir at nearby Rodney Island and Locust Ridge fields (see map). But immediately below the basal Tuscaloosa, a highly permeable and porous sand was found at 8,691-97 ft.; it was here that the Anderson well was finished for 140 bbl. per day on ⅛-in. choke. Gravity of the oil was 40°.

Development of the field has been rapid, thanks to its favorable reservoir characteristics. A pay thickness up to 50 ft. in some wells, permeabilities of 200 to 1,000 md., and reserves of 600 bbl. or more per acre-foot have stimulated the play. So far, the potential of the gas-condensate in the basal Tuscaloosa stands undeveloped. Field limits are yet undefined, but the stratigraphic nature of the accumulation dictates careful subsurface work to trace the course of the barlike sand.

There's plenty of room to play in Tensas Parish. And with results like those at Jett 1 Anderson and at Buckhorn field, this area can look forward to a brisk 1961, despite a sprinkling of dry holes.



RELATIONSHIP of the Illinois basin to its environs is seen along with the thickness of the Chester series. (Adapted from AAPG Bull., Vol. 42, No. 5, May 1958.)

Take another look at the surface for clues to stratigraphic traps

"Many structures have been located with little more than topographic maps and a lot of leg work walking outcrops. Is it possible that some stratigraphic traps may be located in the same manner?"

About the author...

JAMES B. SHREWSBURY is a relative newcomer to petroleum exploration, but his enthusiasm for the challenge that industry problems present caused him to enter this field. He attended Western Kentucky Teachers College and the University of Kentucky. Until WW II he taught in Kentucky public schools. During the war he was a communications officer with the U. S. Naval Air Transport Service, and is now a Lt. Commander, USNR. He is the author of a text, "An Approach to Radio," acclaimed by critics as one of the finest basic texts ever written on this field. Currently, Shrewsbury is using applied electronic techniques in multihole exploration.

WHAT PERSON has never read a story of the man who found oil with his own secret doodlebug, or the man who was successful because he drilled only on sites which were exactly 4,021 ft. due northeast of the center of towns with the name Eldorado, or a water witcher who was doing graduate work in oil?

On the other hand, over the years there have developed certain fundamental and proved methods for scientific search. From time to time these are refined or some new concept is added to their number. New methods may receive widespread publicity and adoption or they may go practically unnoticed until they

are identified with a specific problem.

Perhaps the trend in oil finding is in the direction of those prospects which can be located with airborne instruments or elaborate geophysical work, with a resulting neglect of many potentially profitable but elusive stratigraphic traps. Many structures have been located with little more than topographic maps and a lot of leg work walking outcrops. Is it possible that some stratigraphic traps may be located in the same manner?

In Vol. 42, No. 5, May 1958, pp. 1013-46 of the Bulletin of AAPG, there appeared a report under the title, "Chester Crossbedding and Sandstone Trends in Illinois Basin." This study was the cooperative effort of the Illinois State Geological Survey, Kentucky Geological Survey, and Indiana Geological Survey. It represented the combined work of five eminent geologists who spent a total of 95 days in the field making 1,347 observations on which to base their findings. Unfortunately, to date, this study seems not to have received the attention it merits.

On occasions the publishing of relatively simple material, such as the map prepared by the Illinois State Geological Survey in 1930 which showed the "good, better, and best" areas in Illinois in which to look for oil, give rise to a surprising amount of drilling interest and a resultant high degree of success. Likewise, these crossbedding and sandstone-trend studies which have been reprinted by the cooperating states, may well provide a comparable interest in exploration along the southern rim of the Illinois basin which extends into western Kentucky. Here are some of the features of the study.

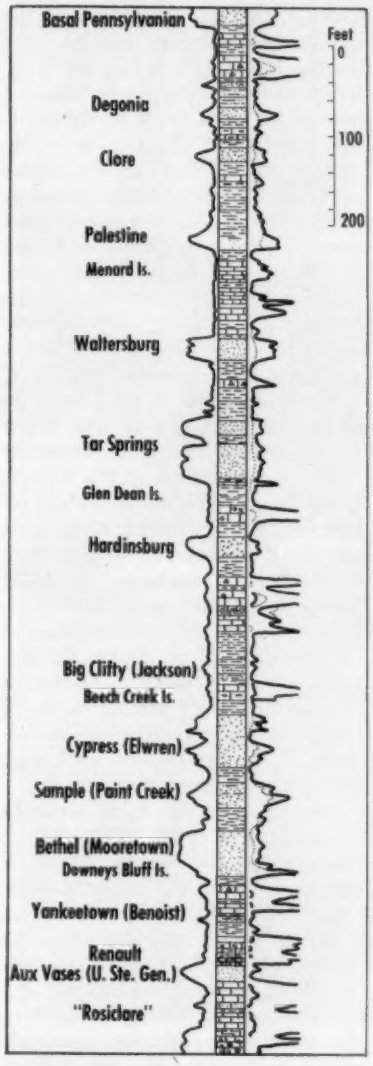
In the Illinois basin, there are known to be considerable lateral variations in the lithology of the Chester series (upper Mississippian), and these variations are most prevalent in the sandstone members. Around the southern rim of the basin, the entire Chester series can be observed in outcrop and, because of the rather steep regional dip, in a distance of a very few miles along the axis of the dip.

The sandstones are observed to have much crossbedding. This study undertook to measure and record the direction of dip of the foresets in the major sandstone bodies. These were then tabulated and a basinwide orientation calculated by statistical methods used for such data.

In areas basinward from the rim in southern Illinois, extensive drilling had provided enough electric-log data to develop subsurface facies maps showing sandstone trends for the formations observed in outcrop. These trends were then compared with the foreset orientation figures. A very good correlation was found to exist.

Throughout Chester times, the area known as the Illinois basin was a slowly subsiding platform, open to the south. Several marine transgressions during this period provided a cyclical sequence of sandstone, limestone, and shale deposition accounting for at least 13 major Chester sandstones, all of which contain important petroleum reservoirs at locations within the basin. (See The Oil and Gas Journal's formation correlator of the United States.) At any point in the basin, some 3 or 4 units of the 13 may dominate. Although some units in some areas may be considered sheet sandstones, isolated sand bodies and lenticular sandstones seem to predominate. In any event, it is certain that the depositional environments of these sandstones included shallow marine shelf, littoral, and, perhaps dominately, fluvial conditions. Ancient stream channels controlled by a southwest-striking tectonic axis provided reservoirs limited by conditions of cementation or other lateral variations in lithology. Strandline deposits are thought to have been minor with the possible exception of the area on the extreme eastern margin of the basin.

It was found that the directional properties of thick well developed sandstones, where they were observed in outcrop, correlated best with mapped trends basinward. If then, both the subsurface trend and thickness of sandstone bodies can be predicted from outcrop studies, are such predictions sufficiently reliable to warrant their use in guiding wildcat drilling in those areas along the rim of the Illinois basin where there is little or no subsurface geology available? If practical tests to prove the economic value of these findings were successful, might they not lead to further exploration based on them and conducted in other similar basins throughout the world?



COMPOSITE LOG of the Chester and Saint Genevieve units in the Illinois basin. (Adapted from AAPG Bull., Vol. 42, No. 5, May 1958.)

The factors which make the area a highly desirable one for exploratory operations are cumulative with those that tempt a practical test of these oil-finding theories. Where in the world can one find a stratigraphic section to cut that will give him a potential pay for every 80 ft. of drilling down to a total depth of approximately 1,300 ft.? (This estimate presupposes that while downhole, in addition to the

Chester, the four pay zones of the middle Mississippian will be cut.) There are no allowables in Kentucky and one may pump what he can. Land costs are low, the territory accessible, there is a ready market, supply and service sources are relatively close, and drilling conditions are good. Many reservoirs have favorable secondary-recovery properties. Here the independent operator is in his element—low investment, reasonably fast payout, and long lived production characterize the Illinois basin sandstones.

What are some of the factors to be considered in making tests based on outcrop observations? Selection of the southern rim of the Illinois basin would allow one to realize the benefits of the extensive study cited above. But since the studies were basinwide in their scope, it is desirable to do additional field work to provide more precise trend and sandstone-thickness data for the particular area chosen. The results of such field work can be expected to provide three or four sandstones of interesting thicknesses, each having a different trend direction.

An adequate test must certainly include several holes. The area selected should be geologically comparable to other proved productive areas not too far removed. Certainly the aspects of structure should not be ignored but there is a growing conviction among geologists and operators along the basin margin that structure is definitely a secondary consideration—at least until the reservoir is found.

The location of the first test hole will be made by selecting the thickest and best-developed sandstone observed in outcrop, then moving basinward in the direction of the indicated trend to a point where the youngest Chester formation is in outcrop. Remember, this direction will be established by studying the orientation of foresets in this sandstone outcrop. Subsequent drilling should be influenced by the additional subsurface data provided by the previous drilling. Should the sand be interspersed with shale or the porosity be poor for other reasons, a move on trend may correct the difficulty. Should the primary target sandstone, when cut, be thin a corrective move in a direction at right angles to the supposed trend may find the main body. Should a good reservoir be encountered but found to contain gas or salt water, correctional moves up or down the regional dip will be indicated.

It must be remembered however that a first location may be made which is a compromise choice for two or more good outcrop observations for different sandstones. With multiple targets and the additional subsurface data provided by the first test, the game can take on the proportions of three-dimensional chess. Indeed, the small Rhodes School pool of Muhlenberg County, Kentucky, has 15 different producing zones for its approximately 100 wells. No doubt about it, stacked traps—or the possibility for them—improve the wildcatter's odds.

Currently, several independent oil producers and their geologists are recognizing the possibility that there are areas along the southern margin of the Illinois basin which are "sleepers." At least some of their exploration will be influenced by local geological field work along the lines suggested here. Perhaps then we may know the value of this oil-finding tool.

Gas discovery finaled in southwestern Kansas

A Morrow Pennsylvanian gas discovery well was completed in Clark County, southwestern Kansas. The well is Graham-Michaelis Drilling Co. and Phillips Petroleum Co. 1-5 Wilson in C SE NW 5-33s-21w, 7½ miles east of Ashland.

The well flowed 7,400 M.c.f.d. from Morrow perforations at 5,252-72 ft. Location is 2½ miles northwest of North Harper Ranch field.

Rooks County. The confirmation well to Simons field in Rooks County was completed for 10 bbl. of oil per day. Cities Service Oil Co. 2 Simons "B," SW NE SW 11-7s-17w, produces from Lansing-Kansas City Pennsylvanian at 2,995 to 3,038 ft. The discovery well was a July well, 1 Simons "B," C NE SW SW 11-7s-17w. It made 71 bbl. per day from Lansing-Kansas City perforations at 2,915-3,021 ft.

Reno County. Tennessee Gas Transmission Co. completed the confirmation well to new Rino field at 1 J. H. Fair, NE NE NW 4-22s-9w. The well made 110 bbl. per day from Arbuckle Cambro-Ordovician at 3,554-60 ft. The new field is on the Reno-Rice County line.

Morton County. Pan American Petroleum Corp. completed a good well in fast-growing Kinsler field, northeastern Morton County. The 1-B Hayward, C SE NW 35-31s-40w, flowed 30,216 M.c.f.d., natural, from Morrow at 5,408-15 ft.

McPherson County. Lee Phillips Oil Co. 1 Engstrom, NE NE NW 22-17s-1w, ¾ mile northeast of Roxbury and east of Henne field, pumped 35 bbl. of oil per day from Mississippian at 2,705-11 ft. through open hole.

Oklahoma wildcat flows Morrow gas

An important new gas discovery is reported in western Oklahoma at Texaco Inc. 1 Nettie Woodruff, C SW NE 4-15n-13w, Blaine County.

The wildcat flowed 4,200 M.c.f.d. through ¾-in. choke from perforations at 10,220-40 ft.

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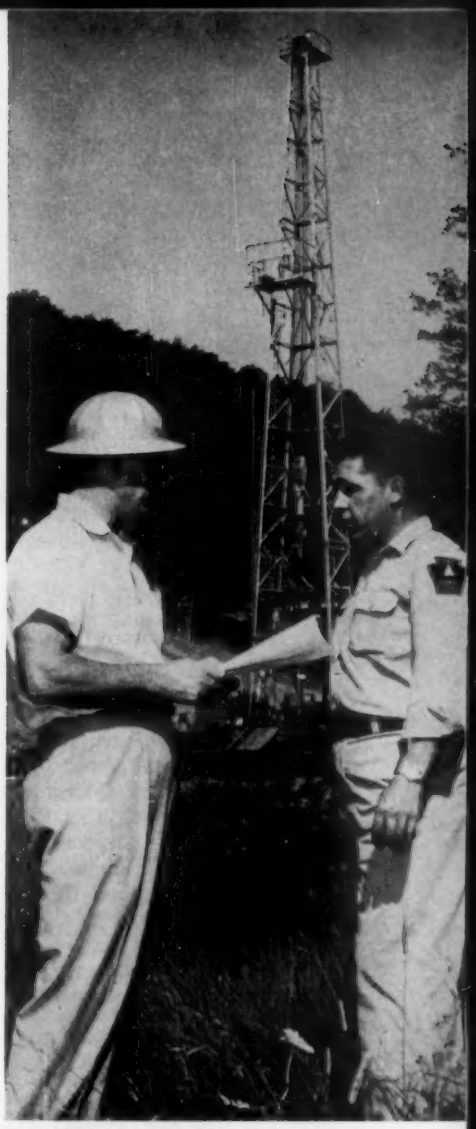
ALL DRILLING on Phillips Ole Bull State Park leases has been handled by a local contractor, Fairman Drilling Co. Here one of Fairman's Drilling crews prepares to bring the drill pipe to the surface.



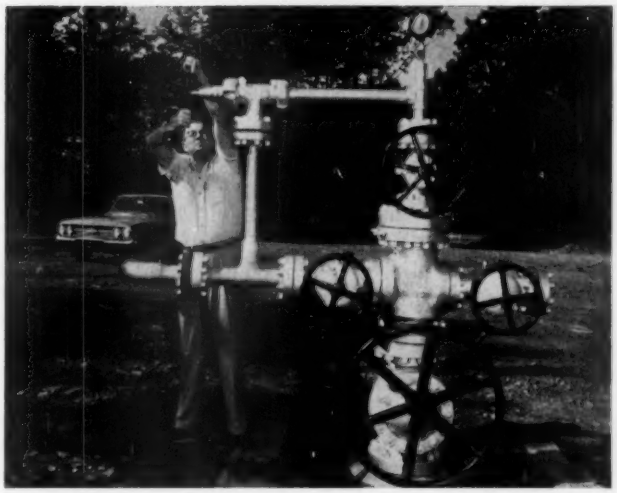
DEVELOPMENT FOREMAN, J. M. "Cotton" Dixon works closely with Pennsylvania State Forest Ranger Al Skutski in Ole Bull State Park to insure the least possible marring of regional forests and wildlife. The two are pictured near Phillips Penn-Tract 81 No. 4.

How to drill without marring the beauty of a state park

DEEP gas exploration in the Appalachian province is at its peak. Phillips Petroleum Co. is in the midst of an exploratory drilling program in Pennsylvania's Allegheny Mountains. Drilling results have been encouraging to date. Of six development wells completed by Phillips, four have been gas producers.

Ole Bull. Potter County is the scene of Phillips drilling campaign. The company has closely coordinated its drilling activities with the Department of Forest and Waters to help protect the natural beauty of Ole Bull State Park where the gas discoveries are being made.

Drilling first began in this area in November 1958 at Penn-Tract 81 No. 1 well. Phillips had



DURING DAILY CHECKS of Ole Bull operations, Cotton visits two producing locations high in the Allegheny Mountains of Pennsylvania. Production at these two wells is from Oriskany-Devonian.

PHILLIPS maintains regularly all company roads leading to the producing area. The company also helps the Park Commission by taking care of minor maintenance work on some of the park roads leading to well sites.

transferred J. M. (Cotton) Dixon to Galeton, Pa., from Guymon, Okla., to act as development foreman for the project at Ole Bull. Dixon worked with Forest Ranger Al Skutski to plan a satisfactory road route through the park—one that would not disturb the forest. This early and close association between Phillips and the Forest Commission of Pennsylvania was maintained during road building and well-site construction, throughout the actual drilling period, long after the first well had been drilled, and continues today.

Timber clearing. Phillips contract crews cut only those trees approved and marked by Ranger Skutski. The timber was separated into lumber for local saw mills and into cordwood for park firewood or pulp mills.

Discovery. The Penn-Tract 81 No. 1 well was completed as a gas producer in May 1959. The gas was contracted for sale to the New York State Natural Gas Co. Phillips immediately cleaned up the well site, returning the location as nearly as possible to its original condition.

During the following year, three more wells were drilled at other locations in Ole Bull State Park. The Penn-Tract 81 No. 3 was completed in November 1959. The other two wells were dry holes. After winter suspension, work was resumed last summer at Penn-Tract 81 No. 4. This well was completed in August as another gas producer. Further drilling in the park is pending, awaiting release of additional locations.

Phillips completed a field well, Penn-Tract 81 No. 5, in October for 4,800 M.c.f.d. with a shut-in rock pressure of 3,900 psi. in 12 hours in the Oriskany sand. This producer is being offset.

Other Phillips activity. The Bartlesville firm has just spudded a wildcat in Greenfield Township, Blair County, on a Pennsylvania State Tract. Nearest wildcat is a dry hole 13 miles to the northeast. Closest production is 22 miles to the west on the Laurel Hill anticline.

Photos and information courtesy PHIL-NEWS.

Pennsylvania's Helvetia adds four pools

DURING NOVEMBER, four wells were drilled in Pennsylvania's Helvetia pool, Clearfield County, in Punxsutawney-Driftwood field.

This pool is in a fault block to the northwest of Rockton pool on the northwest flank of the Chestnut Ridge anticline. Three of the wells were producers and one has been abandoned. The well found salt water and only a show of gas in the Onondagachert-Oriskany sand section.

The three producers found gas in this section. Highest open flow after fracture of the three wells came from the Josephine Carlson well drilled by Felmont Oil Corp. with an open flow of 15 M.M.c.f.d. and a rock pressure of 2,810 psi. in 72 hours.

Dubois pool. Across the Caledonia syncline from the Helvetia pool at Dubois, which is an extension of Boone Mountain pool, a dry hole was drilled. A 3-mile stepout to the southwest found gas in the Oriskany sand. This is the New York State Natural Gas Co. 1 Burt Walls. The well had a final open flow of 1,107 M.c.f.d. and 1 bbl. of salt water. Operator didn't fracture the well.

In Tioga County, a wildcat was plugged and abandoned after penetrating the Oriskany sand and finding no gas.

In Bedford County, a field well in Purcell field was dry.

In Venango County, Burkhardt's well, a wildcat, found salt water in the Oriskany sand and was abandoned.

New wildcats. The status of new wildcats reported follows: Phillips Petroleum Co.'s test in Blair County is drilling at 6,794 ft., nearing the Oriskany sandstone.

Gulf Oil Corp. et al. wildcat in Washington County found 500 M.c.f.d. in the Salt sand of Pennsylvanian age. Pipe is being run at 1,825 ft.

The Cambria County wildcat is still a location. New wildcats during the month include the Donelson Co.'s Harry Leib No. 1 in Dover Township, York County. This well spudded in the Triassic. Delta Drilling Co. is drilling 1-D

Ralston, a wildcat on the Chestnut Ridge anticline in Indiana County. This well is about 20 miles southwest of Rockton pool. An interesting wildcat to watch is New York State's 11 Palumbo, north of Boone Mountain pool on the southeast flank of the Sabinsville anticline. This same company had drilled a well about 1 mile to the northwest farther up the flank of the anticline, but found only a show of gas. It is hoped that the Oriskany sand will be developed farther down the flank of the anticline as in the Boone Mountain pool.

New map available from Pennsylvania

On December 5 the Bureau of Topographic and Geologic Survey, Department of Internal Affairs, Commonwealth of Pennsylvania, released the 1960 edition of the Geologic Map of Pennsylvania. This full-color map is on a scale of 1:250,000 in a pair of 42 by 58-in. sheets. It may be ordered either folded or rolled. Cost is $3.75. Order from Division of Documents, Tenth and Market Sts., Harrisburg. Make checks payable to Commonwealth of Pennsylvania.

Sooner's Kingfisher is drilling success

MOST significant single drilling story in the U. S. of 1960 was the booming success of both exploratory and field-development activity in Oklahoma's Kingfisher County.

Up to Christmas, wildcatters were hitting a whopping 80.1% success ratio and a 96% success ratio in field-well drilling. Out of 26 wildcats drilled, 21 opened new oil and gas pools—out of 99 field wells, 95 were successful. This is indeed a high score for a county where only 62 wildcats had been drilled in the years 1939-1959.

During the past 4 years 25 wildcats drilled in Kingfisher have netted 17 new fields. Several fields opened in 1959 have since merged into new producing areas. This year's wildcatting opened 21 new fields, new pays, or long extensions.

Oil, gas, or both have been found in 14 of Kingfisher's 25 townships. Four townships have yet to be drilled and nine have less than three tests in their 23,040 acres. Production in the county is found in rocks from Ordovician to Pennsylvanian age.

Pay zones include Wilcox Ordovician, Hunton Siluro-Devonian, Meramec, Manning, and Parvin Mississippian, Bartlesville, Red Fork, Oswego, Cleveland, and Layton Pennsylvanian.

Drilling costs. Average cost per well in Kingfisher County is more than $70,000. At North Okarche field, a gas well's costs is about $112,000 with Chester Mississippian at 8,200 ft.

Geologic sketch. Kingfisher County is on the east flank of the Anadarko basin in a downfaulted area just west of the Nemaha granite ridge. More than 10,000 ft. of rock ranging in age from Permian to Ordovician has been penetrated in the county. Deepest well in Kingfisher is in 14-15n-8w. It was a dry hole in the Simpson at 10,140 ft. Three wells have been drilled to the Arbuckle in the eastern side of the county (Jordan).

Permian rocks increase from 2,200 ft. in thickness in the northeast to about 4,000 ft. in the southwest. Pennsylvanian rocks (Virgil, Missouri, and Des Moines) are from 2,500 ft. thick in the northwest to about 5,000 ft. thick in the southwest. Pay zones in the Pennsylvanian are in the bottom 1,000-1,200 ft. Descending, they are: Layton, Cleveland, Oswego, Red Fork, and Bartlesville sands. The Oswego is the main Pennsylvanian target in the county at present.

Mississippian rocks dip and increase in thickness toward the southwest. Chester ranges from 600 ft. in the northwest to about 700 ft. in the southwest. Louise Jordan states that the Chester section decreases in thickness northward in the northwest toward the regional line of truncation. As a result of beveling, the two pay levels in Chester rocks, Parvin and Manning zones of limestone, or, at places, sandstone, are truncated along a general north-south line across the county. Greater than normal thickness is preserved in the northeast corner of the county and extends into southeast Garfield County as the result of either downwarping or faulting previous to Desmoinesian deposition.

Chester. Oil and gas accumulation in the Chester is mostly stratigraphic. Most fields lie on small structural noses contoured at the base of the Pennsylvanian. Manning production is mostly oil at North Dove and in the Hennessey fields. West and south of Kingfisher the Manning produces gas. Parvin sand produces gas and condensate. (Information from The Oil and Gas Journal, and Oklahoma Geology Notes.)

Healthy outlook for B.C. operations

NO SUDDEN SURGE of drilling activity is anticipated in British Columbia in 1961 but Canada's Westcoast Province will see a very healthy rate of operations. This was the view presented by the Hon. W. K. Kiernan, Minister of Mines for the province of British Columbia in mid-December to the annual meeting of the Canadian Association of Oilwell Drilling Contractors. It is expected that about 150 well completions will be tallied in British Columbia this year, about the same as 1959's tally. About one exploratory test is expected for every two field-development wells drilled. There have been around 600 wells drilled so far in this province and it is estimated that 10 times this many will be required to yield even a fair estimate of the true oil and gas potential of the province.

The one major development that could upset this well-completion estimate would be the construction of pipeline facilities from the northeastern sector's oil fields to the major refining area at Vancouver.

There seems little likelihood of this being accomplished in 1961 but meetings between government officials and the four major refinery

operators at Vancouver are rumored and might take place early in January. The refiners involved, Imperial Oil Limited, British American Oil Co., Ltd., Shell Oil Co of Canada, and Standard Oil Co. of British Columbia, an affiliate of California Standard Co., have some direct interests in the British Columbia oil-development play, but much more stake in Alberta's proved crude-oil reserves.

Alberta producers are currently supplying the entire Vancouver refining region with crude and sales of British Columbia oil in this market would displace output from Canada's principal oil and gas-producing province. Fields in the general Fort St. John region of British Columbia are now connected to refineries at Fort St. John and Dawson Creek by pipeline and that same gathering system of Trans Prairie Pipe Line's can deliver crude to railhead. To gain any share of the Vancouver market would at present involve a 700-mile rail haul over the government-backed Pacific Great Eastern Railway. Suggested tariffs for the gathering and delivery of crude to Vancouver by this method would give $1 to $1.50 net back to producer, a seemingly low rate of return in such a costly exploration area.

Why is there little likelihood of an oil-transmission line being built out of northeast British Columbia at present? The present developed, producing potential of the province is just over 12,000 bbl. daily. Producibility could be doubled to 24,000 bbl. daily by fully developing the present proved reserves. This figure could be reached without any new discoveries. Three thousand barrels daily of the potential production is required in the Fort St. John and Dawson Creek refineries. Thus, at present, there is some 9,000 bbl. for other markets. An entirely new pipeline system out of this exploration area, such as that planned by Act Oils, Ltd., to seaboard at Kitamat, would require a throughput of 50,000 to 60,000 bbl. daily to be considered economic.

Even a line south through the center of the province, paralleling the Westcoast Transmission gas line, to link with Trans Mountain around Kamloops-Ashcroft about 200 air miles and closer to 300 pipeline miles east of Vancouver, would require a throughput of about 24,000 bbl. daily. Roughly presently proved but not yet developed potential. A third possibility, but one that is also doubtful would involve the extension of Peace River Oil Pipe Line facilities about 230 miles into northeastern British Columbia. Peace River, a firm backed by 32 separate producing companies all of which have production in northwestern Alberta, was granted a permit to construct this line in December of last year. However, certain stipulations added to the permit made the company back off and not exercise its construction rights.

British Columbia oil-producing companies at present are in much the same position that Alberta gas producers were in 5 to 6 years ago. That is, they had a growing surplus of natural-gas producibility but no appreciable market. Thus, like Alberta's oil wells, income from the British Columbia gassers will have to carry the load of nearly all exploration and development for the interim.

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Oklahoma's Haskell finds another pay zone

An Arkoma basin wildcat, Mobil Oil Co. 1 Quinton in C SE NE 11-7n-19e, Haskell County, southeastern Oklahoma, found another pay, the Cromwell sand at 6,309 ft.

Gas flow was 1,760 M.c.f.d. during tests in this wildcat located near shallow Quinton gas field. Previously, the wildcat had flowed 9,500 M.c.f.d. in the Spiro sand at 5,920 ft.

Pittsburg County. Humble Oil & Refining Co. 1 Moran, SE SE NW 22-5n-12e, third discovery for this firm in the Pine Hollow area west of McAlester, flowed 3,150 M.c.f.d. during tests of the Hartshorne sand at 3,240-78 ft.

Other state news. In western Oklahoma's Custer County, Hunt Oil Co. is testing at 1 Graft-Burmah unit in C SW NW 18-15n-17w. The well flowed 7 M.M.c.f.d. from Mississippian through perforations at 14,761-14,818 ft. Nearest production is at North Custer City field, 8 miles east.

Major County. Arkansas-Louisiana Gas Co. 1-A Ott, C SE NW 27-21n-9w, flowed 640 bbl. of oil per day through 20/64-in. choke from perforations at 7,084-92 ft. in the Mississippian Manning.

Kingfisher County. Jones & Pellow Oil Co. 1 Harak-B, C SW SW 16-19n-6w, East Hennessey field, flowed 696 bbl. per day through 24/64-in. choke from Manning at 6,662-91 ft. and 8 bbl. per hour from Meramec open hole at 6,899-6,944 ft.

Beaver County. Petroleum Inc. added the third oil well to North Fork field in Beaver County at 1 Helfenbain, C SE NW 28-1n-25eCM. The well flowed 45 bbl. per hour or 1,080 bbl. daily from perforations in the Tonkawa Pennsylvanian at 6,088-96 ft. The discovery well of this field, 1 Koch, C NW SE 28, was a dual Tonkawa gas and oil producer.

Love County. In southern Oklahoma's Marietta basin, A. D. Britton opened Deese sand oil production at 1 Smith-McGehee, C SE NE 25-8s-1e, northwest of Northeast Thackerville field.

The well flowed 239 bbl. of oil per day through 12/64-in. choke from perforations at 7,310-15 ft.

Discovery wells

NORTH LOUISIANA

Bossier Parish:

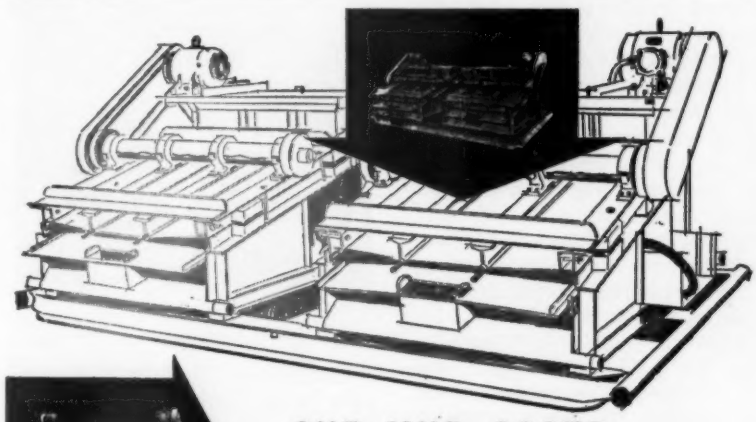
D. P. Magouirk 5 R. Z. Biedenharm et al., 21-21n-14w, 1½ miles northeast of Carett. IP 220 M.c.f.d., 1-in., TP 80 psi., perf. 948-58 ft., Nacatoch. TD 980 ft. Extension discovery in unnamed area.

LaSalle Parish:

Grandstaff & Johnson 1 H. J. Strozier, C NE SW 32-11n-3e, 3 miles southeast of Olla. Open-flow potential 5,200 M.c.f.d., shut-in TP 749 psi., perf. 2,199½-2,201 ft., Wilcox. TD 2,235 ft. Extends Olla field 1⅝ miles northeast.

Tensas Parish:

Jett Drilling Co., Inc., and Phillips Petroleum Co. 1 Tensas Burial & Benefit Association, C NE NE 45-11n-12e. IP 184 BOPD, 9/64-in., 38.8°, TP 1,300 psi., GOR 663 cu. ft. per bbl., perf. 9,129-39 ft., Tuscaloosa Massive. TD 9,207 ft. New-field discovery 1 mile southwest of St. Joseph discovery well and 1½ miles northeast of Locust Ridge field.



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Tower Stresses Fair Play

. . . as a crucial need in a big firm's philosophy. Union Oil official singles out price-finagling for some barbs.

DUDLEY TOWER, a four-sports letterman in college and a former roustabout who now is president of Union Oil Co. of California, uses some plain talk in describing what he feels is the oil industry's biggest problem.

"It's the people in it," he says.

Tower explains that he means the industry's top problem is the lack of statemanship and ethics displayed by the "bigger companies."

As an example, he tells how two majors who moved into the California gasoline market within the last year are selling retail products below major-brand prices. He says they will continue to sell as independents until they capture a share of the market, then jump their prices to the major-brand level.

It isn't the competition Tower dislikes, but the way the majors have invaded the marketing territory as independents. He feels they should operate as majors in all marketing areas, old or new.

Tower caps his argument with this question: "What would happen if Union built some stations in Houston (which is out of the company's marketing territory) and started selling under the market?"

The Union president feels there are some real dangers in the emphasis currently being placed on gasoline marketing. Marketing departments keep the heat on refiners to turn out gasoline at lower cost. In turn, the refiners press the producing and exploration departments to find and produce oil more cheaply.

Dudley Tower
. . . people are the problem

But it's in production and exploration "that we need the help," Tower says, because of rising expenses in these fields.

He points out that cost-cutting is hard to come by in these phases of the business "because we're drilling in less prolific areas and must drill more feet of hole to get the same results we used to get."

Background . . . Tower's appointment as president of Union last fall climaxed a 25-year career with the company. It was in 1935 that he joined Union's gas department as a roustabout in the Los Angeles area. He was 2 years out of college at that time.

Tower had earned quite a reputation in athletics while studying geology and mining engineering at two schools—the University of California and the University of California at Los Angeles. He got letters in football, basketball, baseball, and rugby.

During his first 4 years with Union, he also worked in the producing and drilling departments in California fields. Then he moved to Houston as a district engineer.

Tower was among the original group which established Union's operations on the Gulf Coast and in West Texas. He was in Union's Houston office for 16 years, serving the last 2 as vice president of the Gulf division.

When he returned to Los Angeles in 1955, Tower was made vice president in charge of field operations. He was named to the board of directors the following year and served briefly as executive vice president before being elevated to president last September.

Tower has a "natural" background for a man who is president of a Los Angeles-headquartered oil company. Besides his attendance at UCLA and the University of California, he is a native Angeleno whose birthplace on Sunset Boulevard is not too far from his office in the Union Oil Center.

▶▶▶ Personals

W. H. Peterson has been named Los Angeles division sales manager for Texaco Inc. He succeeds **S. C. Osborn,** now in charge of Texaco's national sales office on the West Coast. Peterson had been special representative in charge of industrial sales in the Pacific Coast region.

Continental Oil Co. is moving four organizational units with 45 people to its Houston headquarters from Ponca City, Okla. Heads of the four units making the move are **Frank E. Butterfield,** crude-oil trading department; **Gordon H. Lovejoy,** product-supply department; **M. A. Snodgrass,** product-distribution department; and **I. A. Harrisberger,** manufacturing operations section of the manufacturing department.

Frank G. Watson, manager of Shell Chemical Co.'s Shell Point plant, Pittsburg, Calif., has been named manager of the manufacturing, plastics, and resins division in New York. **C. H. Plomteaux,** plant superintendent in the Houston plant's industrial-chemicals division, will succeed Watson in Pittsburg.

G. William Sucher has resigned as president of Speedway Petroleum Corp. and as vice president and a director of Aurora Gasoline Co., Speedway's parent company.

Dr. W. A. Bruce, senior research associate with Jersey Production Research Co., subsidiary of Standard Oil Co. (N. J.), has been transferred from Tulsa to London, where he will be on special loan assignment with the Iranian consortium. Bruce is a former production division manager for Jersey Production and has served with Jersey Standard's producing-coordination department in New York.

Dr. William C. Feist has joined Esso Research & Engineering Co. as research chemist.

George Q. Williams, geologist with Texaco Inc., has joined the military petroleum-supply agency of the Department of Defense as commodities analyst, petroleum.

G. O. Webb, district petroleum engineer with Amerada Petroleum Corp. in Duncan, Okla., has been transferred to Oklahoma City as district petroleum engineer.

Norton H. Walton has been appointed assistant operating superintendent in charge of SunOlin Chemical Co.'s Claymont, Del., urea plant. Walton was a supervisor in Atlantic Refining Co.'s chemicals section before joining SunOlin.

Robert E. Rettger, assistant chief geologist, technical, in Sun Oil Co.'s southwest production division, Dallas, has been named division chief geologist. He succeeds **Francis E. Heath,** who has retired. **Wallace Ralston** will take over technical duties handled by Rettger and will continue as assistant division chief geologist, operational.

Research and development divisions at Shell Development Co.'s Emeryville, Calif., laboratory are being reorganized to form four main units: basic and general science, with **D. P. Stevenson** as director; basic and general engineering, **Thomas Baron,** director; oil research and development, **A. J. Wood,** manager; and chemical research and development, **D. L. Yabroff,** manager. Chemical research and development will be divided into: industrial chemicals, with **C. R. Nelson** as director; plastics and resins, **R. W. Martin,** director; synthetic rubber, **John Anderson,** director; and exploratory research, **C. W. Smith,** director. **B. M. Beins, B. S. Greensfelder,** and **Mott Souders, Jr.,** have been named to an advisory council to assist **T. W. Evans,** vice president and general manager. **C. L. Raymond** will be manager of chemical research and development until spring, when he will be succeeded by Yabroff. Raymond will then succeed Yabroff as manager of research and development in Shell Chemical Co.'s industrial-chemicals division.

Paul D. Newendorp, junior petroleum engineer for Pan American Petroleum Corp., has been transferred to Oklahoma City from Duncan, Okla.

Edward A. Ballman, process superintendent at Shell Oil Co.'s Martinez, Calif., refinery, has been transferred to Wood River, Ill., in the same capacity.

Fremont R. (Dutch) Schmieder, general superintendent of the production department in Shell Oil Co.'s Pacific Coast area, has been named San Joaquin division production manager in Bakersfield, Calif.

E. J. Owens has been promoted to group supervisor in refinery technical-service at California Research Corp.'s Richmond, Calif., laboratory. He will supervise work in fluid catalytic cracking.

D. M. Tedford, engineer in the mechanical-engineering department at Humble Oil & Refining Co.'s Baton Rouge refinery, has been given a 2-year loan assignment with Standard-Vacuum Oil Co.

George D. Eichenberger, Jr., has been assigned as engineer in the engineering and planning section of Ohio Fuel Gas Co.'s Columbus, Ohio, general office. **J. Richard Frisbee** has been named junior engineer in the district industrial-sales department, Cambridge, Ohio.

W. M. Jacobs, senior vice president of Pacific Lighting Gas Supply Co., has been elected president. He succeeds **Robert A. Hornby,** who has been named chairman. **Robert W. Miller,** former chairman, continues as chairman of Pacific Lighting Corp., the parent company. Hornby, president of the parent company, and Jacobs, a vice president, will continue in these posts.

Howard E. Kirby, Jr., Shreveport, La., has been named assistant supervisor of Texas Eastern Transmission Corp.'s engineering plans and research division. He had been engineer in the division. **William H. Swinbank** has been named assistant manager of the supply and distribution department of La Gloria Oil & Gas Co., Texas Eastern subsidiary. He will headquarter in Houston.

▶▶▶ Personals

Edwin M. Hubach and **P. D. Campbell** have been elected vice presidents of Williams Brothers. Hubach will be responsible for do-

HUBACH

CAMPBELL

mestic and Canadian construction operations. He will continue to headquarter in Tulsa. Campbell will direct operations in Europe, Africa, the Middle East, and Far East. He will headquarter in London.

Abbas Parkhideh, senior adviser to the board of National Iranian Oil Co., has been named chairman of Iran-Pan American Oil Co., jointly owned by NIOC and Pan American International Oil Co. He succeeds **Ataollah Ettehadieh,** who has retired.

W. A. Gaither, senior mechanical engineer for Sunray Mid-Continent Oil Co., has been promoted to chief project engineer, Tulsa. **Dana L. Smith,** engineer in Shreveport, La., has been transferred to Tulsa as staff project engineer. **Jerry N. Ervin,** process engineer with DX Sunray Oil Co., Sunray Mid-Continent subsidiary, has been promoted to senior process engineer in Duncan, Okla.

Joe M. Wolfe, Rocky Mountain division exploration superintendent for Tennessee Gas & Oil Co., has been transferred to the Midland, Tex., division in the same capacity. **Jess Roach,** Oklahoma City, will replace Wolfe in Denver. **Dan Johnson,** Oklahoma City, has been named division production superintendent in Denver. **R. M. Stevens** will continue as general manager of the Rocky Mountain division. Tennessee Gas & Oil operations are scheduled to be taken over by the new Tenneco Oil Co. in a reorganization by Tennessee Gas Transmission Co., the parent company (OGJ, Dec. 19, p. 62).

Simpson

King

Welch

Cities Service Shuffles Marketers

TO HEAD the Cities Service Co. consolidated marketing operations, the company has chosen F. M. Simpson, the president, general manager and director of Cities Service Oil Co. (Pa.).

A veteran of 37 years with company affiliates, Simpson held a variety of engineering and executive positions, primarily in manufacturing, before his election last week as president and chief executive officer of the new marketing company, Cities Service Oil Co.

He joined Cities Service as a junior engineer at Bartlesville, Okla., in 1923.

The other top men in the new Cities Service marketing company are essentially marketers.

John D. King, executive vice president, is a lawyer who had wide experience in government-industry relations before entering the oil business.

King joined the marketing division of Cities Service (Del.) as counsel in 1944, holding that position until 1954 when he was made vice president, manager, and a director of the company.

J. A. Welch, vice president of the new company, has been an oil man for 45 years—31 of them with the Cities Service family.

Joining Arkansas Fuel as retail sales manager in 1931, Welch became general sales manager in 1933. Six years later he was named vice president and general manager of marketing, the position he held until the reorganization.

Robert William Haigh, financial vice president of Helmerich & Payne, Inc., will become director of planning for Standard Oil Co. (Ohio) early in February.

William Sidwell has been named manager of Rocky Mountain operations for B. F. Allison Drilling Co., Graham, Tex. He succeeds **J. W. Allison,** who has resigned to form Allison Drilling Co., Inc., in Denver.

Mack Atcheson has been promoted to manager of engineering and petrochemical development for El Paso Natural Gas Products Co. **Woodrow W. Mize,** superintendent of the company's Odessa, Tex., butadiene plant, has been promoted to manager of the Odessa chemical complex. **Guy Z. Moore, Jr.,** superintendent of the Odessa styrene plant, has been named manager of petrochemical development with headquarters in El Paso, Tex. **Donald C. Klein,** assistant butadiene plant superintendent, will succeed Mize as superintendent. **John Mills,** assistant styrene plant superintendent, will succeed Moore. **Walter A. Myrick III,** production supervisor at the butadiene plant, will succeed Klein there. **Mark L. Lasly** will succeed Myrick, and **John O. Parks** has been named production supervisor of the styrene plant.

F. H. Wenckebach, general manager of Shell Co. (Hellas) Ltd., has been named general manager of Anglo-Egyptian Oilfields, Ltd., Cairo, and chief representative for Royal Dutch-Shell in the United Arab Republic. He succeeds **F. H. Frangenheim,** who has retired. **O. J. Bronchart,** director of Belgian Shell Co., S.A., will succeed Wenckebach with Shell (Hellas) in Athens.

▶▶▶ Personals

Homer A. Scott, Ohio Oil Co.'s Tulsa production division land man, has retired after 38 years with the company.

C. Robert Robinson, mechanical engineer with Shell Oil Co., has been transferred to Ventura, Calif., from Bakersfield, Calif.

Norman W. Schultz has been named staff assistant in Mobil Oil Co.'s Denver exploration and producing office.

James E. Cox, formerly with Gulf Oil Corp. in Casper, Wyo., has joined Mule Creek Oil Co., Billings, Mont., as geologist.

Howard D. MacPherson, Mobil International Oil Co.'s regional assistant for northern and southeastern Europe, has retired after 32 years with the company and its affiliates.

W. W. Heathman, manager of drilling and production in Union Oil Co.'s Canadian division, Calgary, has retired after 36 years with the company. He had been in Calgary since 1949.

J. B. Jenkins, district superintendent for Pan American Petroleum Corp. in Abilene, Tex., has been named district superintendent for the new Farmington, N. M., producing district office. The Abilene office is being closed. **Lawson F. Jacks,** district geologist in charge of exploration, Abilene, has been named exploration superintendent of the Lubbock, Tex., exploration district. He succeeds **Benjamin F. Baldwin,** recently named Fort Worth division geologist. **F. L. Nabors,** Tyler, Tex., district engineer, has been transferred to Farmington in the same capacity. Also at Farmington will be **G. L. Hamilton,** district clerk, and **L. O. Speer,** who will continue as area superintendent. **W. C. Imbt** is district exploration superintendent there. **S. H. Stocker,** district engineer in Abilene, has been transferred to Tyler succeeding Nabors. Also **J. E. Krath,** area engineer in Sweetwater, Tex., has been transferred to Longview, Tex., in the same capacity.

A. J. Ackerman, group superintendent at Pure Oil Co.'s Crystal Lake, Ill., research center, has been named supervisor of the analytical-chemistry section there.

Norwood L. Varnado, geologist with Shell Oil Co., has been transferred to Jackson, Miss., from Shreveport, La.

Howard G. Carlson has been named manager of Sun Oil Co.'s new Brooklyn sales district. He had been on special assignment in the New York sales region.

William S. Davis, Humble Oil & Refining Co., has been elected chairman of the Permian Basin section of AIME's Society of Petroleum Engineers. Other new officers are **T. W. Kidd,** Gulf Oil Corp., first vice chairman; **Jim Ormond,** Cardinal Chemical, second vice chairman, Midland; **Blake Seay,** Cities Service Oil Co., second vice chairman, Odessa; and **Bob Hurst,** Dowell division of Dow Chemical Co., secretary-treasurer.

JONES

E. R. Jones, refinery manager for Derby Refining Co. division of Colorado Oil & Gas Corp., has been named vice president of manufacturing. Also, **C. J. Carle** has been named industrial relations manager for the manufacturing and pipeline departments. Jones was refinery superintendent before becoming refinery manager in 1958.

R. L. Vockel, Waverly Oil Works Co., has been elected 1961 president of Ohio Oil and Gas Association. Other new officers are **R. C. McConnell,** Clinton Oil Co., vice president; and **S. A. Anderson,** National Gas & Oil Corp., treasurer. Executive committee members include **Henry S. Belden III,** Belden & Blake; **George D. Brabson,** Ohio Oil Co.; **Jack Cashell,** Preston Oil Co.; **L. H. Major,** Valvoline Oil Co.; **P. W. Neuenschwander,** Wiser Oil Co.; **W. E. Shrider,** W. E. Shrider Drilling Co.; **J. W. Straker,** Oxford Oil Co.; and **R. B. Weed,** Columbus independent.

Richard W. Reinhart, general assistant to the general manager of marketing for Mobil Oil Co., has retired.

Thomas F. Taylor, vice president and chief geologist of Grace Oil Co., Houston, has resigned to open offices as consultant in Houston.

A. R. Weller, district geologist for Shell Oil Co. in Ventura, Calif., has been transferred to Seattle in the same capacity.

L. C. Burroughs, assistant to the vice president, manufacturing, for Shell Oil Co., has been appointed consultant on air and water pollution with American Petroleum Institute. He will work with API on a full-time basis until his retirement from Shell in 1962.

Charles F. Scott, marine coordinator for Standard-Vacuum Oil Co., has been named general manger of Socony Mobil Oil Co.'s marine-transportation department. He succeeds **Parker S. Wise,** who will be special assistant to the general manager.

R. J. Fernandez, Gulf Oil Corp., has been elected chairman of the San Joaquin Valley section of AIME. He succeeds **A. J. Horn,** Standard Oil Co. of California, who becomes a director. Other new officers are **C. A. Champion,** Richfield Oil Corp., vice chairman; **K. J. Stracke,** Union Oil Co., secretary; **W. G. Frailing,** California Standard, treasurer; and **H. C. Wiese,** Schlumberger Well Surveying Corp., membership chairman. Directors include **R. A. Ganong,** Lewis & Ganong; **Ken Green,** Mobil Oil Co.; **J. L. Murphy,** Kern County Land Co.; and **Hal Stanier,** Sunray Mid-Continent Oil Co.

Personals

E. C. Walter, Houston, assistant general manager of marketing for Continental Oil Co., has been named northern region manager of marketing. He will headquarter in Kansas City. Walter succeeds **S. N. Bell,** recently named Rocky Mountain region marketing manager. In addition to his most recent assignments, Walter has been a division manager in Chicago and Kansas City, assistant general sales manager, and director of retail marketing for Conoco.

WALTER

R. E. Lindsay, formerly district geologist for Tidewater Oil Co. in Casper, Wyo., has opened consulting offices in Casper.

Dr. Gordon W. Towell has joined Shell Development Co. as engineer at the Emeryville, Calif., research center.

L. H. Johnstone, manager of Phillips Chemical Co.'s Adams terminal on the Houston Ship Channel, has been named manager of sales development in the company's rubber chemicals-sales division. **H. D. Trotter,** manager of the Dumas, Tex., plant, has succeeded Johnstone. **H. E. Haltom,** manager of the Borger, Tex., plant, succeeds Trotter. **W. D. Payton,** manager of Phillips' ammonia plant near Kennewick, Wash., succeeds Haltom in Borger. **W. R. Monk,** process superintendent of the Adams terminal, has moved to Kennewick to replace Payton.

Deaths

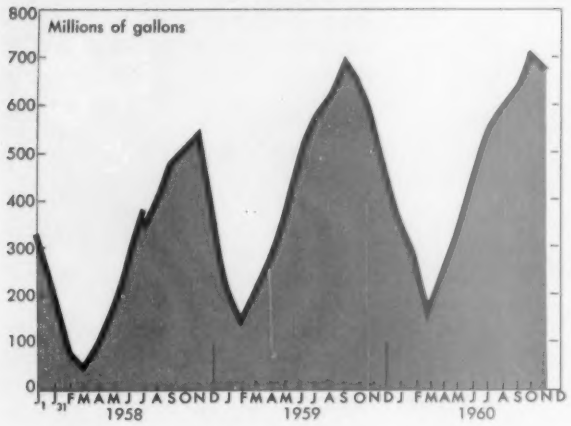
Cipriano (Dick) Andrade III, 62, Dallas independent operator, died January 1 in a New Orleans hotel of a heart ailment.

Thomas W. Parkin, 84, retired general production superintendent for Sun Oil Co.'s Mid-Continent division, died December 30 in a Norman, Okla., hospital. Parkin joined Sun in the late 1890's in Ohio. He had been active in Illinois, Indiana, Texas, and Oklahoma fields before retiring in 1945.

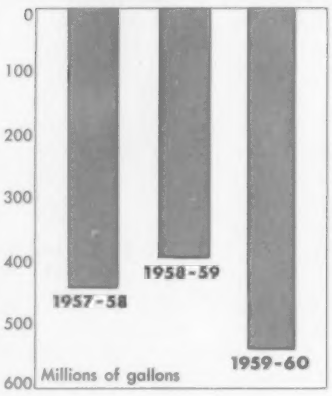
Norman E. Shaw, 38, general manager of industrial-chemical sales for Collier Carbon & Chemical Corp., died December 26 at his home in Palos Verdes, Calif.

Propane in Underground Storage

Plants and Terminals



Winter Withdrawals of Propane From Underground Storage



PROPANE in underground storage reached a peak in October last fall, a month later than in 1959. The total was only 1.1% higher than a year earlier. Winter demand may be up 5% or more. Withdrawals from underground storage will top the 539 million gallons taken out last winter.

LPG stock drop portends good demand

BY JOHN C. CASPER

TOTAL LPG STOCKS normally reach a peak in September or October. In the 1960-61 season it came in October. Total stocks at plants, terminals, and refineries reached a total of 1,348,000,000 gal. at the end of October, according to the latest report of the Bureau of Mines. However, the semimonthly preliminary report by the statistical department of the American Petroleum Institute shows a slightly lower total at the end of October than at midmonth. Stocks had started down in the last half of that month.

The seasonal decline in LPG inventories during the winter months is a function of the number of customers and the weather. This is particularly true for sales early in the winter. For example, colder-than-normal weather in November 1957 brought a reduction in LPG inventories amounting to 10.8%. Weather was warmer the next November, and stocks dropped only 1.5%. You will recall that November 1959 had real winter weather. LPG stocks dropped to 10.9% during the month. November 1960 was a near-normal month with a stock reduction of 4.2%.

Preliminary figures on year-end stocks won't be available until after the middle of January but scattered company reports indicate a big stock drop during the month. Weather was much colder than normal and sales were good.

December and January are the big stock-reduction months for the LPG industry. Also, total withdrawals for these months have been increasing in recent years. In millions of gallons, December-January reductions have amounted to: 220 in 1956-57, 348 in 1957-58, and 421 in 1958-59. If the weather is near normal in January this winter, December - January withdrawals will exceed half a billion gallons.

Prices should remain firm this spring. There will be no big rush to dump material because of a shortage in storage capacity. Operators added almost half a billion gallons to underground capacity last year.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,166,175	UP	40,790	UP	4,119
Crude stocks	236,932,000	UP	32,000	DOWN	18,522,000
Completions	644	DOWN	561	DOWN	192
Refinery runs	8,245,000	UP	236,000	DOWN	124,000
Gasoline stocks	195,703,000	UP	4,380,000	UP	6,737,000
Kerosine stocks	32,048,000	UP	28,000	UP	5,277,000
Distillate stocks	142,246,000	DOWN	7,993,000	UP	567,000
Residual stocks	46,092,000	DOWN	799,000	DOWN	3,846,000
Four-product stocks	416,089,000	DOWN	4,384,000	UP	8,735,000
Total imports	1,860,400	UP	35,400	UP	198,100

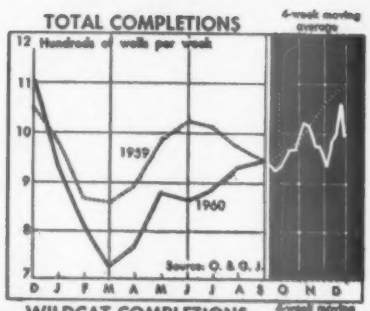
TOTAL LPG STOCKS

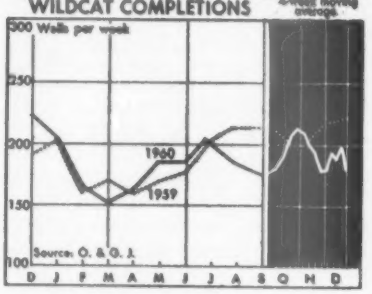
(Plants, terminals, refineries)
(Millions of gallons)

	1957	1958	1959	1960
Jan.	479	516	502	744
Feb.	481	375	469	666
Mar.	555	393	559	579
Apr.	628	481	717	730
May	792	623	913	907
Jun.	902	747	1,031	1,043
Jul.	960	*761	1,122	1,202
Aug.	1,002	854	1,174	1,247
Sep.	1,017	918	1,222	1,346
Oct.	969	937	1,188	1,368
Nov.	864	923	1,058	1,277
Dec.	686	727	873	....

*New basis. Old basis was 820.

Active Rotary Rigs





	1-2-61	12-26-60	1-4-60
Alabama	6	7	5
Alaska	7	7	(†)
Arkansas	10	10	14
Arizona	1	1	0
California	84	84	78
Land	80	80	71
Offshore	4	4	7
Colorado	28	24	39
Florida	5	4	1
Land	2	2	1
Offshore	3	2	0
Georgia	0	2	0
Illinois	26	30	34
Indiana	13	13	7
Kansas	117	123	123
Kentucky	3	4	10
Louisiana	273	280	286
North	35	38	30
S. Inland waters	95	97	110
S. Land	94	94	95
Offshore	49	51	51
Michigan	24	28	37
Mississippi	53	59	68
Missouri	0	1	1
Montana	27	31	18
Nebraska	17	23	24
Nevada	1	1	0
New Mexico	102	108	114
New York	1	1	0
North Dakota	13	15	25
Ohio	4	6	4
Oklahoma	178	194	188
Oregon	1	1	0
Pennsylvania	12	13	14
South Dakota	0	0	5
Tennessee	0	1	0
Texas	628	666	662
S. Inland waters	10	7	6
S. Land	177	184	177
Offshore	3	3	0
North	64	69	160
Panhandle	53	57	(*)
East	44	46	(*)
West Central	‡171	‡174	218
West	106	126	101
Utah	30	32	27
Washington	2	1	1
West Virginia	6	6	4
Wisconsin	1	1	0
Wyoming	62	68	64
Total U. S.	**1,735**	1,845	1,853
Western Canada	161	171	223
Eastern Canada	0	0	1
Grand total	1,896	2,016	2,077

Hughes Tool Co. report. *Included in North. Comparisons not available due to change in method of reporting. †Data first reported 4-4-60. Stephens and Eastland counties now included in West Central.

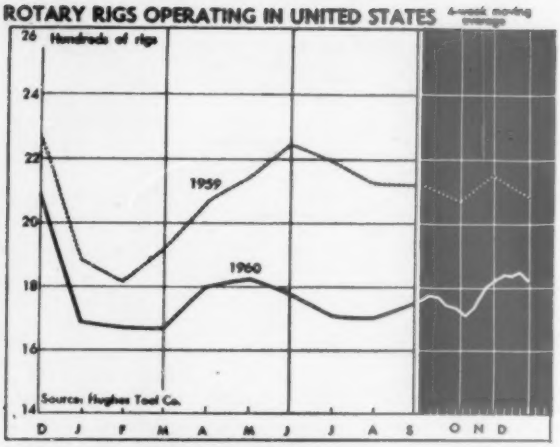
WEEKLY WELL COMPLETIONS . . . WEEK ENDED DECEMBER 31, 1960

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Arkansas	7	3	0	0	4	0	29,975	615	842	1	0	0	0	1	145	146
California	0	0	0	0	0	0	0	1,709	1,530	0	0	0	0	0	302	402
Colorado	14	2	1	2	9	0	77,010	706	809	8	0	0	1	7	358	456
Illinois	30	13	0	1	15	1	66,556	2,373	2,357	9	1	0	1	7	502	391
Indiana	19	7	0	0	12	0	24,517	1,069	880	1	0	0	0	1	366	300
Kansas	101	55	0	6	36	4	253,633	4,288	3,959	19	3	0	2	14	1,056	1,066
Kentucky	16	2	0	1	13	0	21,092	2,180	3,365	2	0	0	1	1	223	389
Louisiana	39	23	0	3	13	0	357,443	3,707	3,781	0	0	0	0	0	552	513
North	0	0	0	0	0	0	0	1,452	1,517	0	0	0	0	0	268	244
South	34	19	0	3	12	0	312,270	1,765	1,853	0	0	0	0	0	250	254
Offshore	5	4	0	0	1	0	45,173	490	411	0	0	0	0	0	34	15
Michigan	0	0	0	0	0	0	0	908	656	0	0	0	0	0	251	180
Mississippi	20	10	1	0	9	0	204,668	694	645	7	2	0	0	5	268	283
Montana	10	6	0	0	4	0	59,461	353	348	4	0	0	0	4	168	121
Nebraska	26	8	0	0	18	0	127,059	896	910	14	0	0	0	14	392	410
New Mexico	23	13	0	8	2	0	128,573	1,850	2,077	0	0	0	0	0	250	260
West	14	5	0	8	1	0	74,088	685	908	0	0	0	0	0	70	64
East	9	8	0	0	1	0	54,485	1,165	1,169	0	0	0	0	0	180	186
New York	0	0	0	0	0	0	0	300	259	0	0	0	0	0	44	22
North Dakota	8	5	0	0	3	0	50,920	283	436	2	0	0	0	2	82	84
Ohio	28	18	0	7	3	0	75,789	1,099	1,133	0	0	0	0	0	55	39
Oklahoma	89	36	0	14	28	11	327,365	4,802	5,359	4	0	0	1	3	700	827
Pennsylvania	0	0	0	0	0	0	0	860	648	0	0	0	0	0	20	21
Texas	176	87	3	25	56	5	748,057	15,581	18,526	18	0	0	0	18	3,166	3,525
Dist. 1	21	9	0	0	9	3	33,597	1,126	1,077	1	0	0	0	1	385	329
Dist. 2	9	1	0	8	0	0	64,221	756	796	0	0	0	0	0	184	232
Dist. 3	8	2	3	0	3	0	61,114	1,163	1,195	0	0	0	0	0	218	234
Dist. 4	10	4	0	2	4	0	72,575	1,074	1,342	1	0	0	0	1	302	356
East	16	6	0	3	7	0	82,663	1,311	1,246	3	0	0	0	3	273	252
Dist. 7-B	26	9	0	2	15	0	74,465	2,231	2,623	9	0	0	0	9	631	694
West	32	27	0	3	2	0	230,440	3,976	5,494	0	0	0	0	0	632	747
Dist. 9	34	20	0	0	12	2	47,947	2,903	3,483	4	0	0	0	4	484	573
Dist. 10	20	9	0	7	4	0	81,035	1,041	1,270	0	0	0	0	0	57	108
Utah	3	1	0	0	2	0	20,165	243	318	1	1	0	0	0	96	101
West Virginia	15	4	0	8	3	0	34,695	884	806	0	0	0	0	0	11	29
Wyoming	18	8	0	1	9	0	93,714	1,074	990	9	1	0	0	8	435	375
Misc. (Ala.)	2	2	0	0	0	0	22,971	276	259	0	0	0	0	0	190	133
Total U. S.	**644**	303	5	76	239	21	2,723,663	46,750	50,893	**99**	8	0	6	85	9,632	10,073
Previous week	1,205	619	24	102	388	72	4,006,862	.....	.....	205	14	2	9	180	.....	.....
Cum. 1960	*46,750	21,236	1,306	4,015	17,506	2,687	191,114,152	.....	.....	9,632	854	112	324	8,342	.....	.....
Cum. 1959	50,893	25,379	1,255	3,761	19,101	1,397	208,249,518	.....	.....	10,073	873	113	340	8,747	.....	.....
Western Canada	15	5	0	0	10	0	84,723	2,276	2,505	9	0	0	3	6	589	694

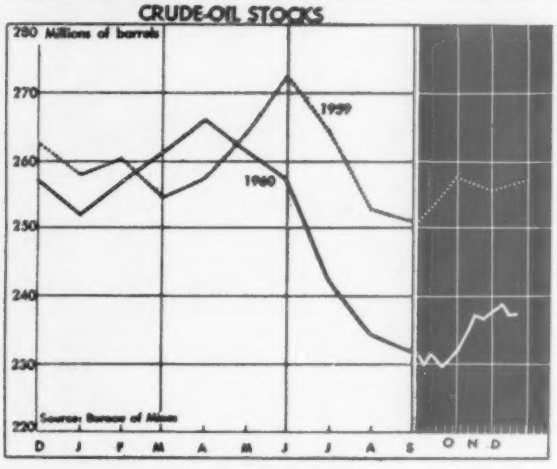
*All figures final except for: California, Louisiana, Michigan, and W. Virginia.

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*
(Thousands of barrels)

	12-24-60	12-17-60	12-26-59
Pennsylvania	2,279	2,324	2,380
Other Appalachian	1,304	1,360	1,261
Illinois, Indiana, Michigan	8,749	8,725	9,574
Nebraska and North Dakota	2,705	2,799	3,343
Kansas	9,070	8,813	9,880
Oklahoma	15,982	15,585	16,731
Arkansas	1,771	1,760	2,011
Louisiana	18,798	19,084	17,428
North	3,003	3,176	3,213
South	15,795	15,908	14,215
Mississippi, Alabama, Florida	1,943	1,660	2,408
New Mexico	7,749	8,023	7,952
Texas	100,418	101,673	112,280
East Texas	7,517	7,645	7,785
West Texas	45,363	47,233	52,906
Texas Gulf	18,793	18,230	21,586
Other Texas	28,745	28,565	30,003
Wyoming	17,279	16,917	16,988
Other Rocky Mountain	9,970	10,225	9,608
California	26,083	25,888	28,973
Foreign	†12,832	12,064	14,637
Total	**236,932**	236,900	255,454

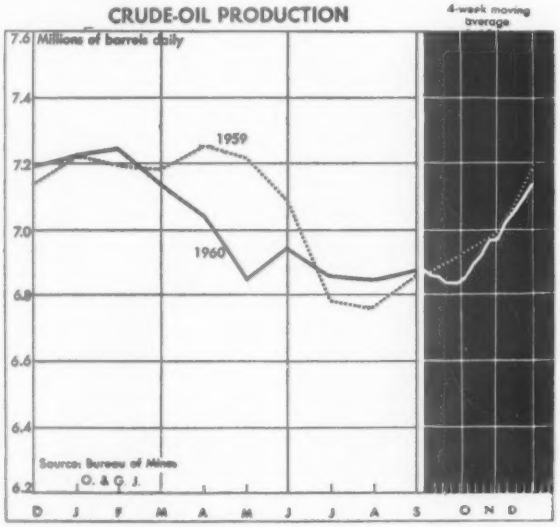
*Bureau of Mines. †Includes 4,255,000 bbl. in California.

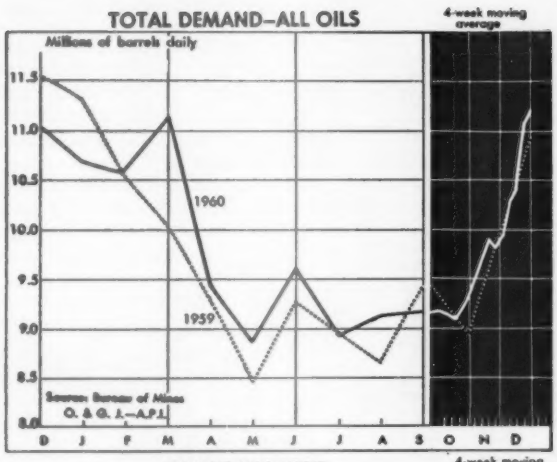
DAILY AVERAGE PRODUCTION FOR WEEK

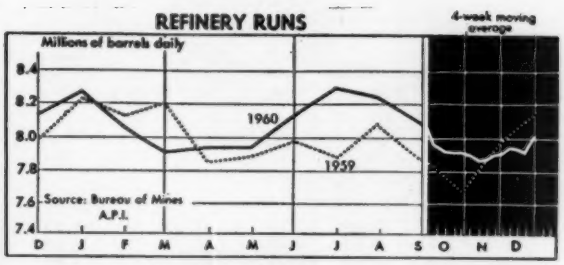
	December 31, 1960			Dec. 24
	Crude oil	Lease condensate	Total	total
Alabama	21,200	.....	21,200	21,500
Alaska	5,125	.....	5,125	5,125
Arkansas	74,440	110	74,550	74,600
California	835,000	.....	835,000	835,600
Colorado	132,000	.....	132,000	131,600
Eastern	37,000	.....	37,000	37,500
Florida	875	.....	875	875
Illinois	220,300	.....	220,300	219,200
Indiana	32,800	.....	32,800	32,700
Kansas	†298,100	.....	†298,100	†289,510
Kentucky	59,100	.....	59,100	59,200
Louisiana	968,300	135,500	1,103,800	1,103,800
North	105,300	5,500	110,800	110,800
South	863,000	130,000	993,000	993,000
Michigan	48,500	.....	48,500	48,500
Mississippi	146,775	4,100	150,875	150,875
Montana	81,000	.....	81,000	79,600
Nebraska	64,700	.....	64,700	64,900
Nevada	100	.....	100	50
New Mexico	292,000	8,500	300,500	300,500
North Dakota	71,000	.....	71,000	70,300
Oklahoma	†548,000	.....	†548,000	†518,300
Texas	2,500,000	90,000	2,590,000	2,590,000
Dist. 1	44,000	3,200	47,200	47,200
Dist. 2	108,000	8,300	116,300	116,300
Dist. 3	320,000	38,350	358,350	358,350
Dist. 4	179,000	12,200	191,200	191,200
Dist. 5	27,000	500	27,500	27,500
Dist. 6	109,000	9,800	118,800	118,800
East Texas field	133,000	.....	133,000	133,000
Dist. 7-B	123,000	400	123,400	123,400
Dist. 7-C	117,000	3,150	120,150	120,150
Dist. 8	1,041,000	10,400	1,051,400	1,051,400
Dist. 9	199,000	2,000	201,000	201,000
Dist. 10	100,000	1,700	101,700	101,700
Utah	108,900	.....	108,900	110,300
Wyoming	382,000	.....	382,000	380,100
Others	‡750	.....	‡750	‡750
Total U. S.	6,927,965	238,210	**7,166,175**	7,125,385
Change from previous week, up			**40,790**	
Canada	†532,000	.....	†532,000	†574,200
Total U. S. prod., Jan. 1-Dec. 31			2,572,768,000 bbl.	
Same period last year (crude plus cond.)			*2,574,590,000 bbl.	

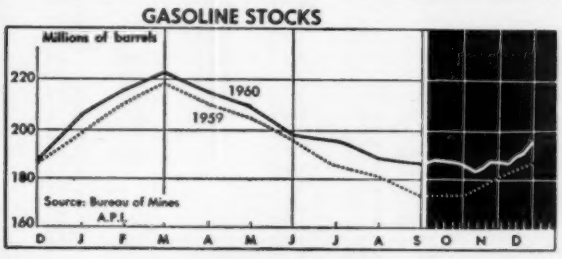
*Includes 69,651,900 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

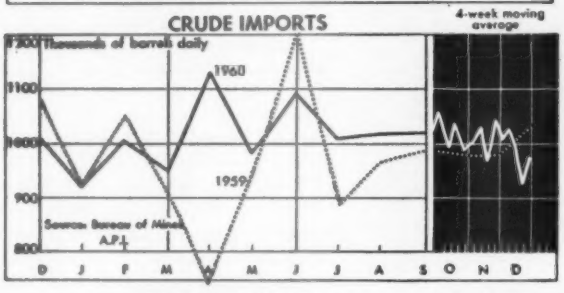
CRUDE-OIL PRODUCTION

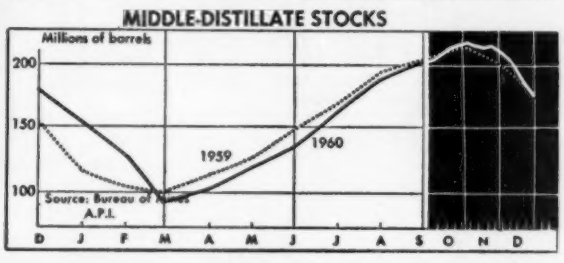


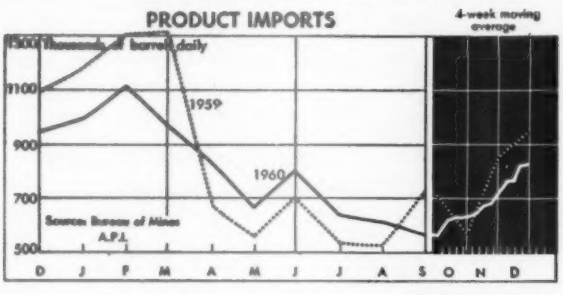

TOTAL DEMAND—ALL OILS
Millions of barrels daily
4-week moving average
1960
1959
Source: Bureau of Mines
O. & G. J.—A.P.I.
D J F M A M J J A S O N D

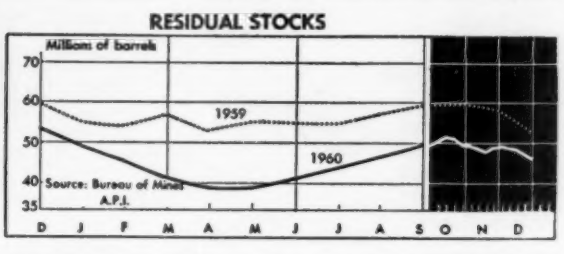












API REFINERY REPORT—DECEMBER 30, 1960

(Thonsands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, December 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,033	517.6	43.3	326.7	139.7	44,386	12,769	53,283	13,203	1,119	524.9	39.8	359.0	149.4
Appalachian:														
District 1	102	41.4	3.3	23.7	14.9	5,845	832	3,884	523	104	42.9	3.7	23.1	14.8
Dist. 2	100	53.0	7.0	20.9	15.6	2,985	373	1,633	358	110	55.3	7.7	19.5	20.2
Ind., Ill., Ky.	1,565	785.6	82.7	325.7	203.9	31,700	6,348	24,871	6,389	1,548	798.6	82.6	359.4	231.7
Minn., Wis., Dak.	130	62.4	4.7	31.1	23.0	7,041	1,179	7,373	523	121	58.9	5.6	30.7	18.1
Okla., Kans., Mo.	788	437.6	26.7	205.4	30.3	17,377	1,376	11,981	944	699	381.5	15.5	199.5	26.1
Inland Texas	286	227.7	8.3	49.4	19.4	6,892	589	1,593	2,506	291	211.3	9.5	48.5	22.0
Texas Gulf Coast	1,920	1,028.7	163.6	515.8	159.9	28,133	3,254	13,452	5,502	1,877	980.1	117.9	460.1	154.5
La. Gulf Coast	634	370.4	65.9	128.1	36.7	10,819	2,025	5,370	1,131	714	363.0	87.0	163.5	47.5
N. La. and Ark.	109	63.9	4.1	23.4	7.0	5,540	1,272	2,888	159	101	46.7	6.7	23.5	8.1
Rocky Mountain:														
New Mexico	23	12.9	0.4	4.4	3.4	907	53	138	14	23	14.2	0.6	4.1	2.3
Other Rky. Mt.	290	149.0	6.0	70.4	33.7	6,039	312	2,722	1,099	293	141.9	3.9	69.6	34.4
West Coast	1,265	543.8	42.1	233.1	270.3	28,039	1,666	13,058	13,741	1,143	534.7	4.8	178.5	277.5
Dec. 30, 1960	8,245	4,294.0	458.1	1,958.1	958.0	195,703	32,048	142,246	46,092	8,143	4,154.0	385.3	1,939.0	1,006.6
Dec. 23, 1960	8,009	4,171.3	415.4	1,919.6	911.0	191,323	32,020	150,239	46,891	.....	.....	.....	.....	.....
Jan. 1, 1960	8,369	4,230.4	459.4	2,018.4	991.3	188,966	26,771	141,679	49,938	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	....	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.75-4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Buckeye Grade 4.08

Illinois Basin **3.00-3.05**

Foreign

Middle East, Persian Gulf:
(cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41.0°-41.9°, Umm Said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Weyburn (light) 2.06
- Midale C 1.69

Venezuela:
- Cumbarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)
- Gulf-NY, dirty (ATRS+5%) $2.99
- Gulf-NY, clean (ATRS+20%) 3.42
- Carib.-NY, dirty (ATRS—25%) 2.06
- Carib.-UK, clean (Scale+12.5%) (40s. 8d.) 5.68
- PG-UK, dirty (Scale—25%) (42s. 2d.) .. 5.91

★Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- Regular (91 octane) .. 12.25-12.50
- Premium (99 octane) . 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 11.00
- Regular (92 octane) .. 11.25
- Premium (98 octane) . 12.25

California (rack) Los Angeles:
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) . 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) ..10.125-10.25
- Premium (97 octane) . 11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 .... 10.875
- Diesel oil (58 d.i. and above) 10.50
- Distillate No. 1 .... 10.50
- Distillate No. 2 .... 9.50

Gulf Coast (cargoes):
- Kerosine 41-43 .... 9.25-9.50
- Distillate No. 2 .... 8.50

New York Harbor (barges):
- ★ Kerosine 42-43 .... 11.15
- ★ Distillate No. 2 .... 10.15
- ★ Diesel fuel, 48-52 d.i. 10.55

Caribbean area (cargoes):
- Distillate No. 2 .... 8.125

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.90

Gulf Coast (cargoes):
- Bunker C fuel 2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C 2.10

California (rack):
- Bunker C fuel, Los Angeles 2.25

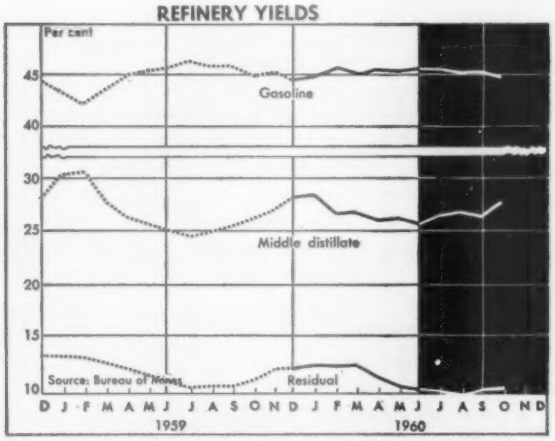
SUPPLY AND DEMAND—MAJOR PRODUCTS

(Thonsands of barrels daily)

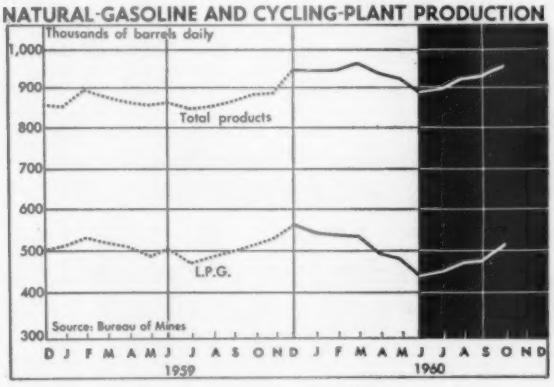
	Total demand	Refinery production	Stocks end of period†
GASOLINE			
December 1960*	4,000	4,170	196,000
November 1960*	4,065	4,030	187,150
October 1960	4,109	4,083	189,674
January 1960	3,654	4,238	205,982
December 1959	4,044	4,188	187,115
KEROSINE			
December 1960*	590	427	31,900
November 1960*	425	430	36,930
October 1960	352	387	36,547
January 1960	479	437	26,510
December 1959	514	385	26,817
DISTILLATE			
December 1960*	2,985	1,890	141,100
November 1960*	2,130	1,855	173,100
October 1960	1,475	1,815	180,071
January 1960	2,806	1,931	125,924
December 1959	2,651	1,939	151,030
RESIDUAL			
December 1960*	1,780	944	46,000
November 1960*	1,480	865	49,250
October 1960	1,359	831	50,003
January 1960	2,042	1,047	49,306
December 1959	1,937	1,007	53,261

*Preliminary. †Thousands of barrels.

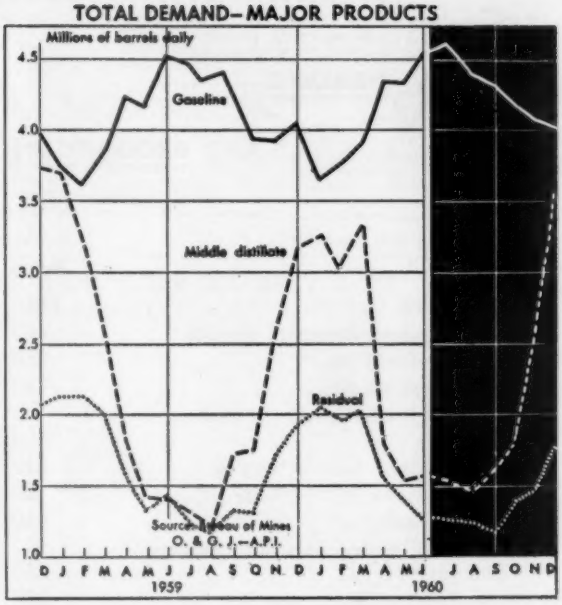
REFINERY YIELDS



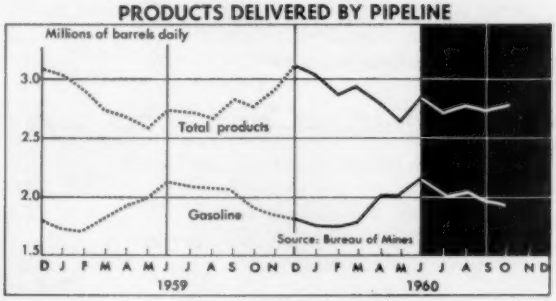
NATURAL-GASOLINE AND CYCLING-PLANT PRODUCTION



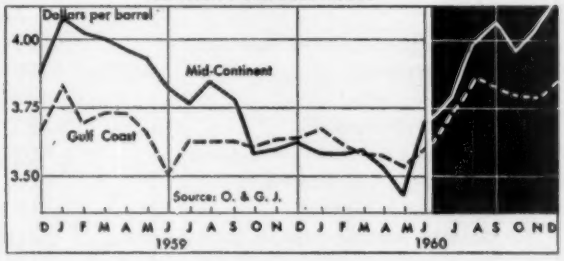
TOTAL DEMAND—MAJOR PRODUCTS



PRODUCTS DELIVERED BY PIPELINE



REFINERY REALIZATION



REFINERY REALIZATION

	Dec.*	Nov.*	Oct.	Sept.
Mid-Continent	$4.16	$4.07	$3.97	$4.04
Gulf Coast	3.85	3.79	3.83	3.81

*Preliminary. Refinery realization is based on yields of major products and average spot prices of regular gasoline, kerosine, No. 2 fuel, and residual as published in The Oil and Gas Journal.

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1/4" x 18"	12	5/16" x 48"	19
5/16" x 20"	10	1/2" x 48"	4
1/4" x 20"	4	3/8" x 48"	12
1/2" x 24"	2	3/8" x 54"	6
3/8" x 24"	15	5/16" x 60"	1
5/16" x 24"	9	3/4" x 72"	4
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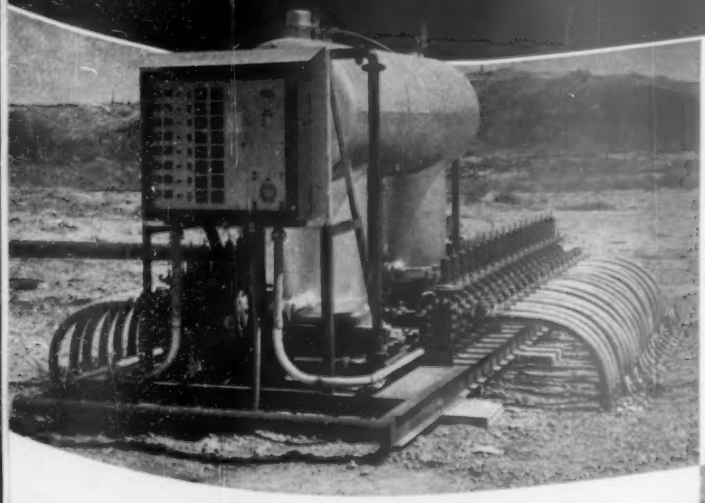

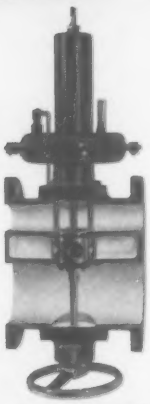

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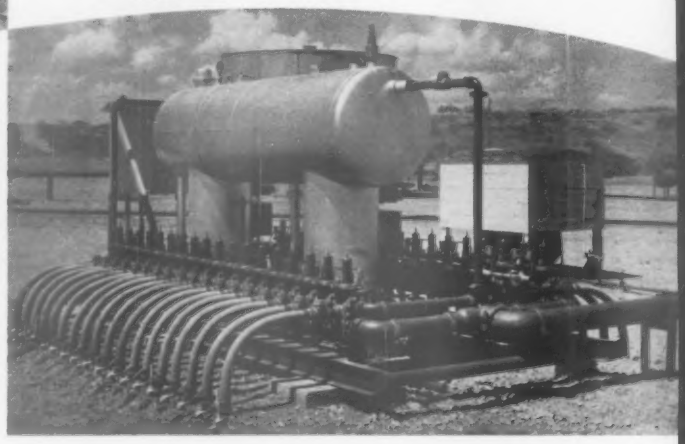

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Proper operation of pumping well.
Accurate well performance.

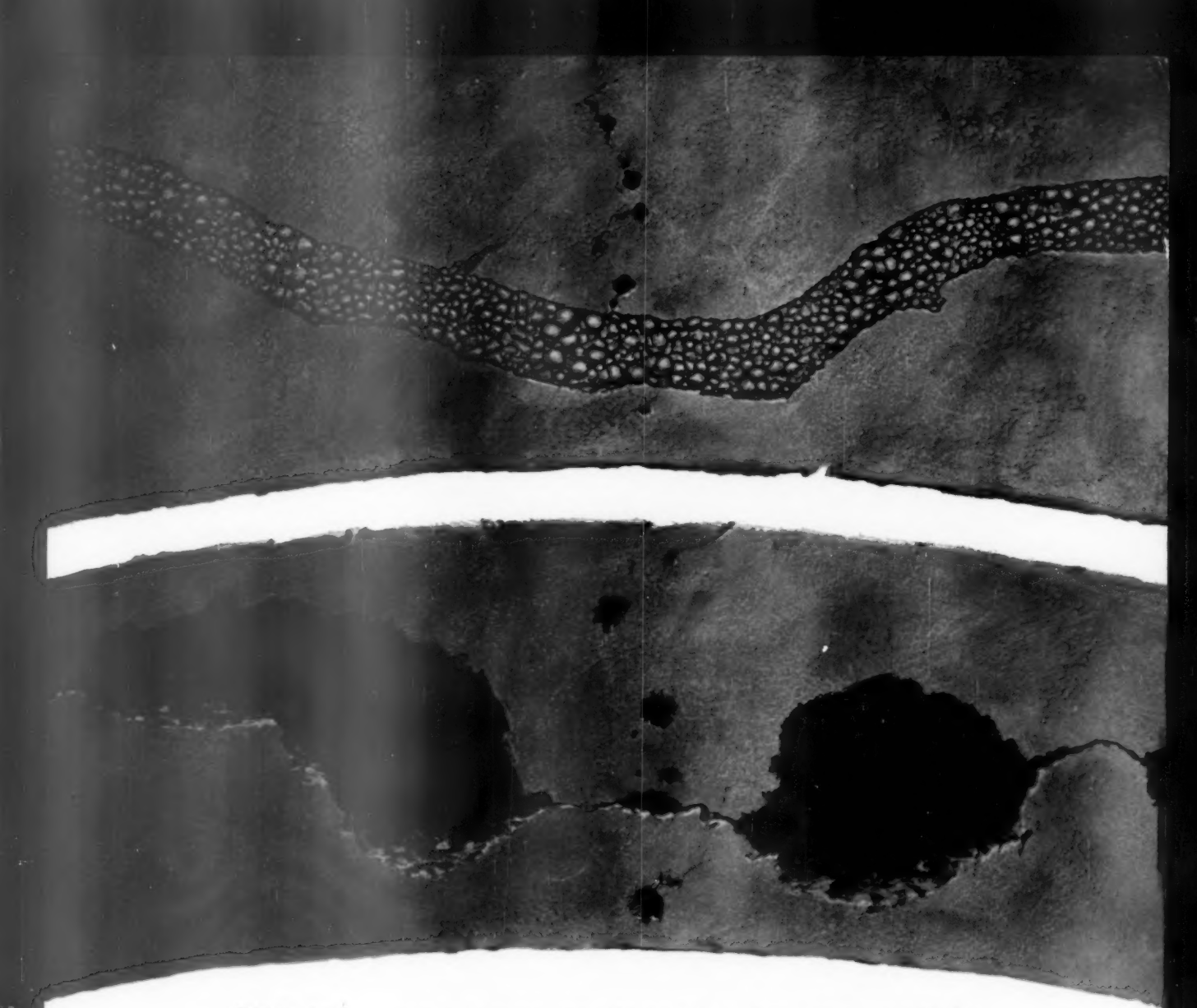
A Plus Value With All National Products . . . Engineers and field crews living in your area with stocked warehouses, complete units or parts ready to size, install and service National Well Test Units!

It's a National®

NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA



Which treatment makes the better well ?

These inside-the-well-bore views of enlarged sections of treated formation, as visualized by an engineer, compare two methods of stimulation.

The top illustration represents a sand-packed fracture after conventional fracturing. This type of treatment often gives good production increases at low cost. Many wells, however, do not respond profitably to these treatments. Small production increases, rapid production declines, or trouble with sand returns may limit profits.

The bottom illustration depicts the probable result of a new type of Dowell treatment. It uses slow-reacting Retarded Acid injected at a high rate to create open flow channels over a large drainage area. Since the etched formation supports itself, there is no need for using sand that might crush, imbed, or flow back with production. This new treatment technique is giving excellent production increases in many areas.

Which treatment is better for you? Your Dowell representative can help you decide when he knows the facts about *your* well, *your* production requirements and *your* profit objectives. Check with him now! Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma.

SERVICES FOR THE OIL INDUSTRY DOWELL DIVISION OF THE DOW CHEMICAL COMPANY

OSC-3AJ

-the jet bit with built-in speed... and records prove it!

The Hughes OSC-3AJ is fast . . . it's rugged, and it's versatile. Some of the records set with the OSC-3AJ are spectacular. As an example, a Gulf Coast well was recently drilled to 10,000 feet in 3 days and 7 hours: actual rotating time — 46 hours. Only five bits were used; one 12¼" and four 9⅞".

The previous record for a 10,000-foot well in this area was made with Hughes OSC-3J's. We don't pretend that the penetration rate or footage drilled in the record well is par for the OSC-3AJ. But one thing this record does prove is the outstanding performance built into the bit.

The Hughes OSC-3AJ was originally designed for "top hole" digging. But its exceptional performance in low-strength, high-drillability formations and its availability in a wider range of sizes is extending its use to greater depths and in an increasing number of areas of the world.

Ask the Hughes man in your area about the performance you can expect with the OSC-3AJ

HUGHES TOOL COMPANY ORIGINATOR

AND WORLD'S LEADING DEVELOPER OF CONE-TYPE ROCK BITS